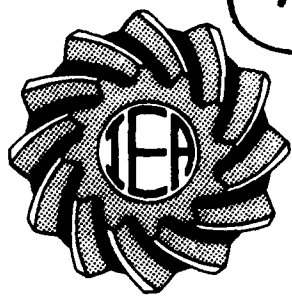


U.S. ARMY MATERIEL COMMAND

PRODUCIBILITY & PRODUCTION ASPECTS OF THE MARKET ANALYSIS PROCESS

JUNE 1989

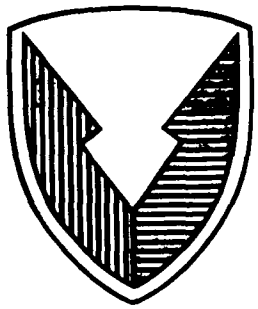
DISTRIBUTION UNLIMITED, DOCUMENT FOR PUBLIC RELEASE

Prepared By

NATIONAL SYSTEMS MANAGEMENT CORPORATION
ALEXANDRIA, VIRGINIA 22312

For

U.S. ARMY INDUSTRIAL ENGINEERING ACTIVITY
ROCK ISLAND, IL 61299-7260



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This publication reports on the degree of emphasis accorded to producibility and production issues early in the acquisition process within the Army Materiel Command and the Training and Doctrine Command. Data and information for the report was acquired during visits to selected Major Subordinate Commands; TRADOC Headquarters and Centers; and the Logistics Management Institute. Subjects include: Overview of streamlined acquisition process/nondevelopmental item identification/procurement; NDI project initiation; market surveillance data bases/degree of automation/locations; access to domestic and foreign data bases; producibility and production information within data bases; interface between AMC and TRADOC; and producibility and production issue related conclusions.

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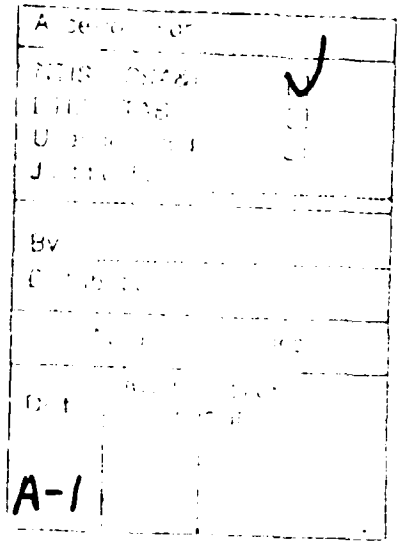
FOREWORD

In late 1988, a series of studies concerning nondevelopmental items (NDI), acquisition streamlining and the market analysis process led to several conclusions. From a production perspective, it was concluded that methods and/or procedures are needed to assure that producibility and production readiness concerns have been addressed on NDI acquisitions and that market analysis findings are factored into the milestone decision process.

This report focuses on the degree of emphasis accorded to producibility and production issues in the early phases of materiel acquisition programs.

A most sincere thanks is extended to the members of the U.S. Army Communications-Electronics and Tank-Automotive Commands; the Belvoir Research, Development and Engineering Center; Headquarters, Training and Doctrine Command; the U.S. Army Signal and Transportation Centers; and the Logistics Management Institute for their assistance and cooperation, without which this report could not have been prepared.



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EXECUTIVE SUMMARY

This task includes an overview of the market analysis process, acquisition streamlining, and an assessment of how producibility and production issues are treated. The basic objective of this effort was to determine the degree of emphasis accorded to producibility and production issues in the early phases of materiel acquisition programs. The report itself is based on interviews with selected U.S. Army Materiel Command (AMC) and Training and Doctrine Command (TRADOC) personnel, supplemented by reviews of applicable documents and Army regulations.

Significant findings are as follows:

- In general, combat developers do not address producibility and production issues early in the acquisition cycle. There is an assumption that these issues are premature during concept definition and are really the materiel developer's responsibility. Materiel developers are well aware of the potential impact of these issues on program cost, schedule and system performance requirements; nevertheless, they tend to defer producibility and production issues until system requirements are well defined. It does appear that TRADOC (the combat developer's representative) has an appreciation of the need for producible designs and would be receptive to earlier involvement by materiel developers.

- Adequate policy and procedural guidance has been published emphasizing the importance of close cooperation between combat and materiel developers. However, in many cases, the lack of an early dialogue between the TRADOC proponent Centers and the appropriate AMC MSCs or RD&E Centers causes potential issues to be ignored. These issues could impact program cost, schedule and performance requirements later in the acquisition cycle.

- Acquisition Streamlining requires the performance of many activities concurrently in order to maintain cost and schedule goals. The pace of a streamlined program tends to move producibility and production issues to the side unless these issues are aggressively

pursued by producibility and production engineering personnel having direct or influential program involvement.

- Market surveillance data maintained by the materiel developers is generally not readily available to combat developers. Ready access to MS data would enhance the combat developer's ability to develop concepts which address producibility concerns. For the most part, MS data is manually maintained by technical experts in the respective RD&E commodity centers.

- Adequate DoD and Army sponsored courses of instruction are available to prepare middle and senior level military and civilian personnel for research, development and acquisition assignments. However, there appears to be a lack of emphasis concerning the importance of addressing potential producibility and production issues early in the acquisition cycle and that these issues are joint concerns of both TRADOC combat and AMC materiel developers.

- To address these concerns, several recommendations are offered in SECTION 5.0, RECOMMENDATIONS.

SECTION 1.0
INTRODUCTION

1.1 GENERAL

This report assesses the Army Materiel Command (AMC) and the Training and Doctrine Command (TRADOC) relationship, their roles in the market analysis process, and the impact of producibility and production considerations on this process.

The market analysis process is composed of two principal activities -- market surveillance (MS) and market investigation (MI). Army Regulation (AR) 70-1, Systems Acquisition Policy and Procedures, 10 October 1988, describes this process and these activities as:

- Market Analysis: "An umbrella term comprised of two principal activities (market surveillance and market investigation) that provides information on technologies, existing hardware, inherent industrial capabilities, determining the basic data necessary to satisfy a material need."

- Market Surveillance: "A systemic effort to gather information/data for the purpose of developing and maintaining an awareness of marketplace technologies and products with potential for Army use. It is a generic, ongoing functional activity conducted in support of the mission of the organization performing the surveillance that provides a database which is used as a starting point for the Concept Formulation Process."

- Market Investigation: "A systematic effort to gather information/data on marketplace technologies and products that will satisfy a specific Army need. It is a programmatic activity conducted in response to an O&O [Operational and Organizational] plan for the purpose of gathering sufficient data that will form the basis for developing the acquisition strategy to satisfy a particular program requirement."

The Defense Systems Management College (DSMC) defines the terms producibility and production in its instructional material as:

- Producibility: The relative ease of producing an item or system, which is governed by the characteristics and features of a design that enable economical fabrication, assembly, inspection, and testing using available production technology.

- Production: The conversion of raw materials into products and/or components thereof, through a series of manufacturing processes. It includes the functions of production engineering, controlling, quality assurance, and the determination of resource requirements.

1.2 BACKGROUND

Traditional Acquisition Process:

The traditional 10- to 15-year acquisition process shown in the upper half of Figure 1-1, Acquisition Process Comparison, has been criticized as too long and too costly, often

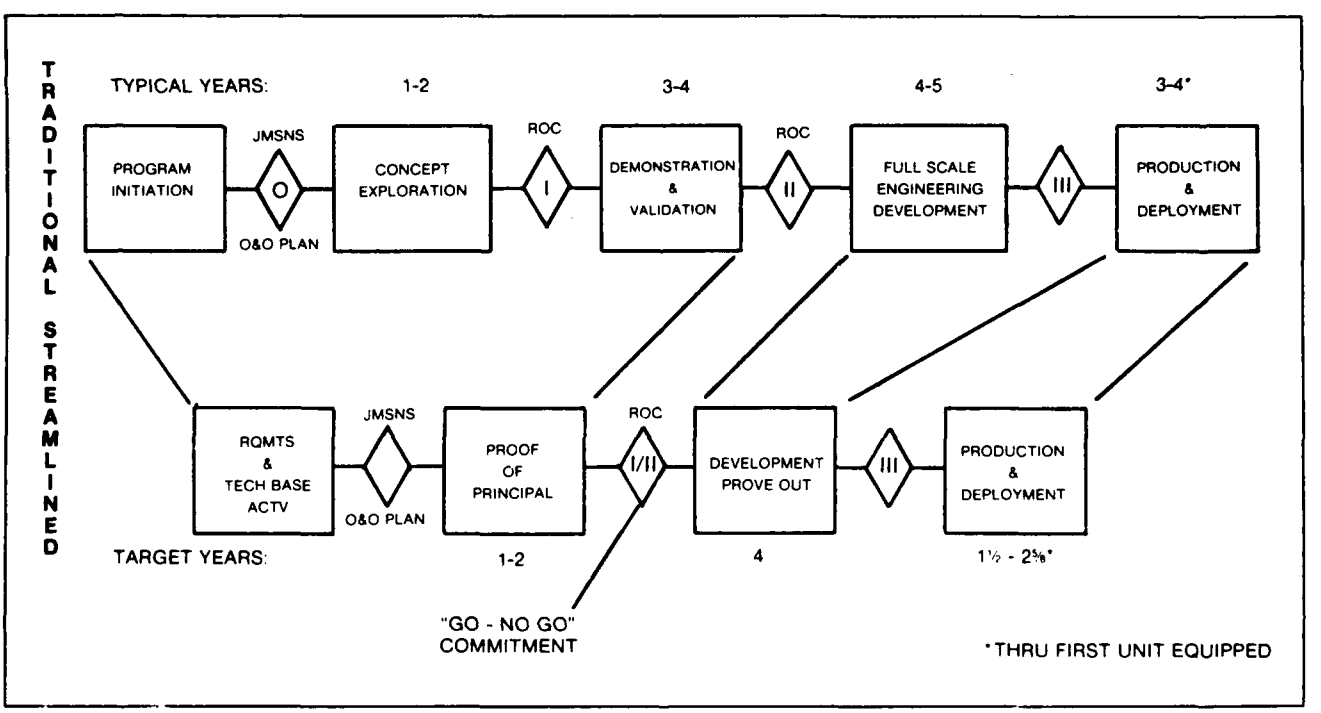

Figure 1-1

resulting in the fielding of obsolete technology. With the goals of reducing development costs and schedules and of fielding state-of-the-art technology, a complete re-examination of the traditional acquisition process led to the development of a streamlined process, shown for comparison purposes in the lower half of Figure 1-1.

Acquisition Tailoring and Streamlining:

The October 1988-revised AR 70-1 endorses acquisition tailoring and streamlining. Acquisition streamlining is a synergistic combination of common sense measures to achieve a short, but sound, path for low risk developments, while eliminating the need for case-by-case exceptions to the traditional acquisition process. Where conditions warrant, streamlining permits programs to move from the technical base directly to engineering development (by-passing the advanced development phase) and, in some instances, moving directly to production.

Another, but equally important, way of understanding acquisition tailoring and streamlining is to focus on the following areas:

- Requirements - Structure for near term, low risk development.
- Growth - Through Pre-Planned Product Improvements.
- Technology - Early focus on mission area needs.
- Formal Milestones - Reorient and eliminate where practical.
- Proof of Principle Phase - Scale down and combine the traditional Concept Exploration and the Demonstration/Validation phases.
- Test and Evaluation - Integrate, eliminate redundancy, and capitalize on previously certified test data.
- Production - Ensure a solid prove-out.
- Nondevelopmental Items - The preferred acquisition alternative to new system development.

Figure 1-2, Order of Procedure - Acquisition Strategy, shows alternative strategies in descending order of preference. The middle strategies -- off-the-shelf, militarize/ruggedize, and standard subsystem assembly -- represent typical NDI approaches. As the figure illustrates, these three strategies are preferable to higher cost, new development alternatives.

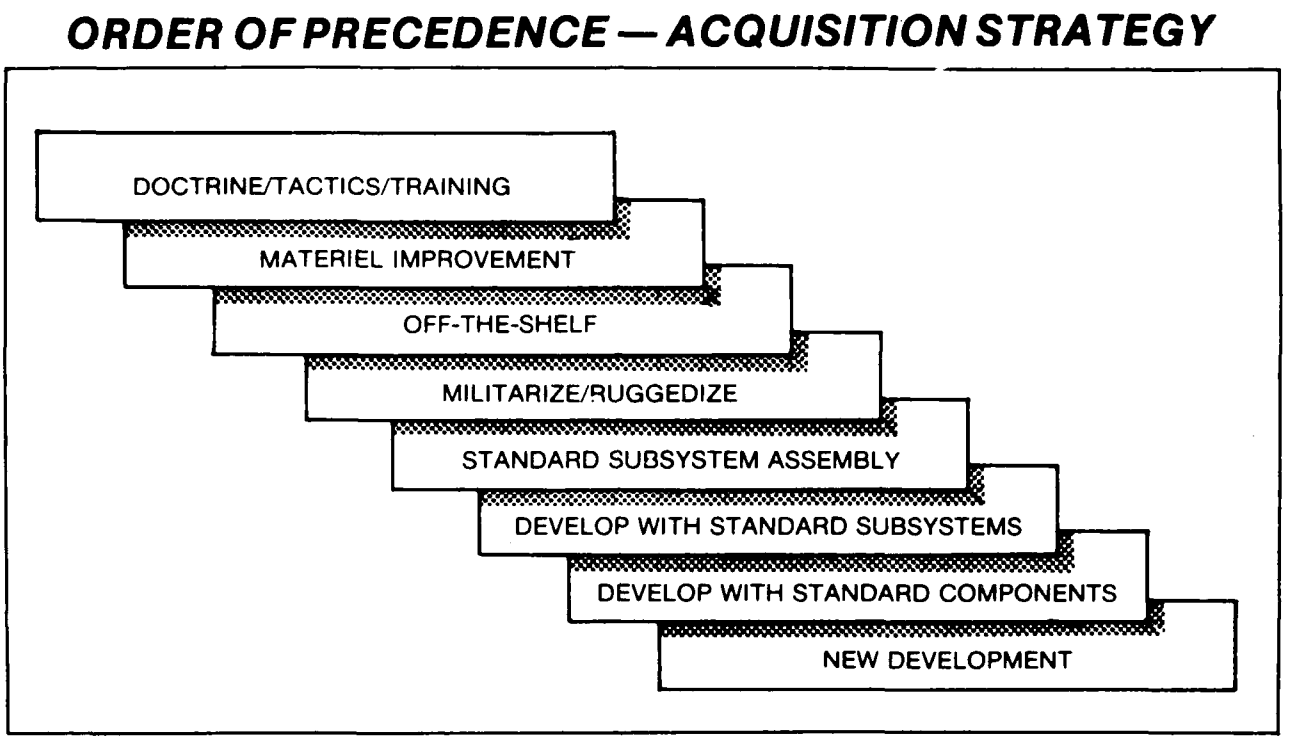

Figure 1-2

Nondevelopmental Items:

The application of acquisition tailoring and streamlining to reduce acquisition timeframes and the acquisition of NDIs logically go together; they are the ideal combination of both schedule reduction and cost reduction. AR 70-1 defines NDI (also referred to as an already-developed or off-the-shelf item) as:

- Nondevelopmental Item: Those items available for procurement to satisfy an approved materiel requirement from existing sources (such as commercial items and items developed by other government agencies, U.S. military service, or countries) requiring little or no additional development.

NDI Producibility and Production Issues:

To some degree, virtually all systems acquired for military use are nondevelopmental. Larger systems are normally comprised of many sub-systems and hundreds (if not thousands) of separate piece parts or components previously qualified either as better grade commercial or as military specified. For nondevelopmental systems, production may be a more important consideration than producibility. Systems which are wholly nondevelopmental, currently being produced, and of acceptable quality present the least risk in terms of both producibility and production issues, but even minor changes to make such systems acceptable for use in a military environment may elevate the risks associated with these issues.

Separate NDI systems may appear quite acceptable as stand alone items. However, grouping these separate NDI systems as subsystems of larger assemblages presents a different set of problems, primarily in the area of systems integration. Separate items (subsystems, major components and selected piece parts) from multiple sources do not always function together as originally expected. Minor alterations to subsystems in order to achieve interoperability objectives pose another series of potential producibility and production problems.

Streamlining Producibility and Production Issues:

Acquisition streamlining does not eliminate normal program management requirements. However, streamlining encourages tailoring the acquisition strategy to eliminate, abbreviate or overlap program activities after careful examination of all program requirements. For NDI acquisition programs, many of the design engineering efforts can be eliminated. Also, abbreviated test and evaluation efforts may be acceptable when sufficient certified data exists to warrant a waiver of more extensive efforts. Nevertheless, overlapping such activities may pose problems. There is an inherent risk to any concurrence in activities that are undertaken to satisfy program management requirements.

SECTION 2.0

CONDUCT OF THE MARKET ANALYSIS ASSESSMENT

2.1 OBJECTIVES AND ISSUES

Primary and Secondary Objectives:

The primary objective of the market analysis assessment was to determine if producibility and production considerations are addressed during market analysis activities. Secondary objectives were to determine:

- The degree of emphasis accorded to producibility and production considerations and how they are treated as part of the NDI acquisition process.

- If producibility and production issues were addressed during the market surveillance or market investigation portions of the market analysis process.

- The types, sources and locations of market surveillance data which may be of use for producibility and production consideration purposes.

- How surveillance data is collected, stored and distributed to include the use of magnetic media.

- The availability of off-shore surveillance data and how they were obtained.

- Interactive relationships between the materiel developer (AMC) and the combat developer (TRADOC).

Issues:

Based on the discussions relating to the primary and secondary assessment objectives, potential issues to be addressed included, but were not limited to:

- The degree (if any) that producibility and production readiness considerations affect the conduct of market surveillance activities.

- The consideration of producibility and production readiness by combat developers during development and approval of O&O plans.

- The utility and worth of automating and unifying producibility and/or production data in market surveillance data bases.

- The advisability of recommending that AMC promulgate additional policy and guidance with respect to producibility and production readiness in the market analysis process.

- Other issues identified during the market analysis assessment.

2.2 METHODOLOGY

Overview:

The market analysis process is performed to: 1) catalog available producers and have access to other similar commodity data bases, 2) identify candidate sources of supply, and 3) determine if candidate suppliers can meet Army quantity, quality, cost and schedule requirements. The methodology to determine how Army materiel and combat developers manage this performance was to:

- Conduct market analysis literature searches.

- Select those AMC and TRADOC organizations in which a relatively high percentage of market analysis activities are performed.

- Plan and conduct a series of visits to these selected organizations to obtain first-hand information concerning market analysis activities.

- Analyze all of the information gathered during the literature searches and visits.

Selection of Organizations:

Investigations regarding the level of market analysis activities focused first on the AMC MSCs (materiel developers) which appeared to have the highest levels of market analysis activity. The investigation revealed that the "top three" MSCs were:

- U.S. Army Communications-Electronics Command (CECOM).

- U.S. Army Tank-Automotive Command (TACOM).

- U.S. Army Troop Support Command (TROSCOM).

The next step was to identify the combat developers for the systems and equipment developed by CECOM, TACOM and TROSCOM. The combat developer for most communications and electronic equipment is the U.S. Army Signal Center and School, Fort Gordon, GA. The combat developers for most TACOM materiel are the U.S. Army Transportation Center and School, Fort Eustis, VA (wheeled vehicles); the U.S. Army Armor Center and School, Fort Knox, KY (M1 Abrams tank); the U.S. Army Infantry Center and School, Fort Benning, GA (Bradley Fighting Vehicle System); and the U.S. Army Engineer Center and School, Fort Leonard Wood, MO (construction equipment). The combat developers for most TROSCOM general purpose systems and equipment are the U.S. Army Quartermaster Center and School, Fort Lee, VA (fuels handling and storage, water purification and distribution); the U.S. Army Engineer Center and School, Fort Leonard Wood, MO (construction equipment, mine warfare); and the U.S. Army Military Police Center and School, Fort McClellan, AL (physical security).

Scheduling of Visits:

With the limited amount of time available to conduct the market analysis process assessment, visits to AMC and TRADOC organizations were scheduled so as to maximize the visibility of the process during a four-week period, including travel time. The locations visited, in priority, were:

- CECOM, identified as the MSC with the highest volume of nondevelopmental item procurements (which must be preceded by some degree of market analysis activity).

- U.S. Army Signal Center and School, as the prime combat developer for CECOM products.

- TACOM, identified as an MSC with a somewhat lesser volume of nondevelopmental item procurements, but one with which all commands readily identify as the source for ground transportation products.

- U.S. Army Transportation Center and School, as the prime combat developer for many (wheeled vehicle) TACOM products.

- TROSCOM Belvoir Research, Development and Engineering Center (BRDEC), identified as the TROSCOM materiel development Center of Excellence (lead laboratory) for Engineer, Military Police and Quartermaster products. BRDEC, by virtue of its geographical location at Fort Belvoir, the home of the Engineer Center until the end of Fiscal Year 1989, also has considerable experience relating to Corps of Engineers combat development doctrine. In addition, BRDEC (transferred to TROSCOM in the last major AMC reorganization) has extensive procurement experience.

- Headquarters, TRADOC, was visited in conjunction with travel to the Transportation Center at Fort Eustis, VA. This visit gained much information and insight into TRADOC's combat development policy-making activities; its coordination, prioritization, and meshing of new and improved system requirements on behalf of all the Army proponent schools; and the AMC/TRADOC interface early in the acquisition cycle.

- One commercial firm, the Logistics Management Institute (LMI), Alexandria, VA, was visited to discuss its NDI data base networking activities under an AMC contract for the development of a Foreign Market Analysis System.

SECTION 3.0

MARKET ANALYSIS ASSESSMENT VISITS

3.1 HEADQUARTERS, U.S. ARMY TRAINING AND DOCTRINE COMMAND

General:

The TRADOC office of the Deputy Chief of Staff for Combat Developments was visited on 29 March 1989. This office develops and promulgates policy and procedures for TRADOC proponent centers and schools. It is also the central point within TRADOC for overall coordination, management and prioritization of new and improved system concepts developed by the proponent schools.

Organizational Structure:

The TRADOC organization has a much larger ratio of military to civilian staffing than does AMC. Generally, the percentage ratio is:

TRADOC	AMC
MILITARY 70/30 CIVILIAN	MILITARY 8/92 CIVILIAN

As the Army's user representative, TRADOC enjoys the advantage of a continual infusion of military personnel having recent, real-world experience with systems and equipment. This equipment is operated and maintained by soldiers with the typical education, experience and skill levels found in all sectors of American society. Consequently, TRADOC has a different perspective of what is needed to maintain or enhance warfighting capabilities than does AMC. TRADOC is, for the most part, divorced from the issues of producibility and production. But, TRADOC gradually is becoming more attuned to the need for producible designs which can be translated into production quantities.

Because the TRADOC centers and schools have such a high percentage of uniformed personnel, military education for leaders, managers and staff officers receives a great deal of attention. One goal is to place more emphasis on the development of the commissioned officer 51-series Military Occupational Specialties (MOSs) in order to lessen the emphasis on warfare and provide viable career paths in materiel acquisition. The concept is for these officers to serve tours in organizations with materiel development, combat development and field organization missions (interlaced with breaks for school attendance). Unfortunately, only a relatively small percentage of the officer corps can be given this type of career development; these people are just the ones needed in the combat development arena to bring subjects such as producibility and production into focus.

Front End Producibility and Production Considerations:

The meeting at TRADOC was a candid exchange of concerns and issues and was preceded with a brief overview of the types of issues being explored as part of the market analysis assessment. The core question was: Does anyone in TRADOC look at the issues of producibility and production early in the acquisition process? The response was: not really. The rationale for this response was:

- Concepts for new or improved systems that are developed and promoted by the proponent schools address only warfighting capabilities or their direct support. The assumption is that producibility and production issues are premature concerns at that time.

- Producibility and production issues are more of an AMC responsibility.

- Generally, the linkage between the proponent combat developers and the RDT&E segments of the materiel development communities (AMC MSCs) is thought to be weak and may, in some cases, be nonexistent. This may explain why producibility is not surfaced while concepts are still in the embryo stages of development.

- There is an assumption of production readiness for already developed products. These items frequently are marketed and demonstrated to combat development personnel at the TRADOC proponent schools just as they are to the materiel development communities

at the AMC MSCs. TRADOC user representatives therefore may feel apprehensive about questioning the producibility of these products or of new product offerings which employ similar technology.

- Although chapter 17 of the joint AMC/TRADOC Pamphlet 70-2, Materiel Acquisition Handbook, 1987, contains excellent guidance on the process leading to the selection of non-developmental items, its discussions concerning market analysis activities leave the reader with the understanding that AMC has the lead to 1) maintain market surveillance data, and 2) to conduct market investigation activities; and the impression that no need exists for TRADOC to recommend initiation of surveillance or investigation activities.

As the handbook states, TRADOC must work closely with AMC in obtaining MI data. The issue is -- what data? TRADOC concentrates on the capabilities of equipment to perform missions, whereas AMC concentrates on how to acquire the equipment (which includes producibility and production considerations).

Related issues which were discussed:

- Approval and funding for concepts which require new or improved equipment. To many people, it appears futile to consider the producibility and production aspects of an acquisition program until there is a high degree of confidence that the program will be approved and funded.

- The practice of over-specifying (gold plating) requirements is perceived as a tactical approach to hold a requirements cushion for bartering. This tends to obscure the need to consider producibility and production until compromises are made. Although a practice such as this is not condoned, the tactic of "asking for more but accepting what is needed" is an accepted fact of life. Little interest in the issues of producibility and production should be expected until all the agreed system characteristics and capabilities are determined.

- Two important drivers affecting consideration of all concerns early in the acquisition cycle are 1) the recognition of potential problem issues such as producibility and production, and 2) the personalities of the key combat and materiel developers at TRADOC and AMC.

Frequently, the lack of an early dialogue between the combat developer and the materiel developer leaves unaddressed concerns which later become problems that impact on program cost, schedule and systems performance.

TRADOC/AMC Link:

The link between the proponent combat and materiel developers appears, in most cases, to be the strongest between the TRADOC System Manager (TSM) and the AMC Program Executive Office (PEO)/Project Manager (PM) offices. This link is established in a fairly routine manner by the approval of the TSM and PM charters authorizing development of new materiel or prove-out of NDI materiel. By this time, general agreement normally has been reached concerning materiel performance envelopes, minimum reliability requirements (mission performance), the operational environment, types of military organizations to which the materiel will be issued, the desired quantities to be procured, and the time frame in which the materiel must be developed, proved out and procured to meet Army schedules for new or modified Table of Organization and Equipment (TOE) fielding.

The earlier links between the TRADOC developers of combat concepts and the AMC technology bases appear to be less strong. During the early stages of concept definition, there may be insufficient contact between the combat concepts developers and the AMC engineers who are concerned with preliminary design, logistics and production engineering tasks. These engineers can make significant contributions during the early stages of concept development to expose potential materiel development issues, to include producibility and production considerations.

Regulatory Guidance:

The revised Army Regulation 70-1, System Acquisition Policy and Procedures, dated 10 October 1988, was staffed jointly between TRADOC and AMC. It reflects mutually agreed procedures to guide both combat developers and materiel developers throughout the concept, development, prove-out, procurement and fielding stages of systems acquisition. Both the traditional and streamlined acquisition models are discussed in this regulation. Producibility and

production concerns are addressed as part of the seven major objectives of research, development and acquisition.

Objective "c(6)" in paragraph 1-4 of the AR requires the development and acquisition of systems meeting user needs that "are producible and fully supportable by the Army logistics system." By itself, the statement appears acceptable; however, TRADOC staffing generally is composed of logisticians, not production engineers. The logistician will consider supportability, but he may not view producibility as a logistics concern.

Objective "d" is to "maintain a strong technology base that will provide fundamental technical information in support of materiel requirements, system development, and production and materiel improvement." TRADOC concerns are oriented towards operational needs, equipment quantities and all aspects of logistics support in the field. Production concerns will receive much less attention.

Paragraph 2-20 of AR 70-1 states, in part, that TRADOC, as the principal Army Combat Developer, formulates materiel requirements, prioritizes materiel needs, and represents the user in the materiel acquisition process. Specifically, TRADOC develops concepts for materiel, prepares requirements documents for new materiel, coordinates with materiel developers and PEO/PM offices, develops the Long Range Research, Development and Acquisition Plan (LRRDAP) and Mission Area Materiel Plan (MAMP), and provides considerable documentation for the Concept Formulation Process (CFP). However, these TRADOC planning activities do not specifically address producibility and production. The direction in AR 70-1 is simply for TRADOC to coordinate with the technology base and acquisition segments of the materiel development community, and to assess the best methods to satisfy needs. Still, this coordination is critical; it provides the windows of opportunity for TRADOC and AMC to surface mutual concerns about acquiring and developing producible designs and about procuring acceptable quantities of affordable products.

TRADOC has the lead responsibility for the Concept Formulation Process, as discussed in paragraph 4-3 of AR 70-1. There is a requirement to consider producibility and production when the materiel developer prepares the Best Technical Approach (BTA) (one of the CFP documents); however, neither producibility nor production are highlighted in this paragraph.

Appendix E of AR 70-1 is devoted to market analysis. This appendix discusses production in two places: 1) types of industry, which highlight production capacity, and 2) sources, which highlight the suitability and availability of products to meet Government requirements in sufficient quantities without necessitating unique or special production runs. This appendix does not address producibility.

Material Acquisition Handbook:

One of the best and more widely accepted Army publications on the subject of acquisition is AMC/TRADOC Pamphlet 70-2, Materiel Acquisition Handbook, 1987. Chapter 17 of this pamphlet is devoted to NDI acquisition. Section IV of chapter 17 includes a discussion on market surveillance and market investigation activities. The two most important features of this pamphlet are: 1) it was jointly developed by AMC and TRADOC and presents mutually agreed procedures for both the combat and materiel developer communities, and 2) being in a three ring, loose-leaf binder format, it can easily be updated, chapter by chapter, to reflect current policy and practices for acquisition managers and their technical support personnel. Also, as a mutually agreed guide for the manager and the doer, it is in ideal form to reach the combat developer audiences. Copies of AMC/TRADOC Pam 70-2 may be obtained through normal distribution channels, from the National Technical Information Service (NTIS), Springfield, VA, or the Defense Technical Information Center (DTIC), Cameron Station, VA.

Influencing the Process:

One of the discussion issues was: In practical terms, how can the production engineering segments of the R&D and materiel acquisition communities influence the consideration of producibility and production issues early in the acquisition cycle? When looking at who does what, it is probably unrealistic to expect the combat developer to become deeply involved with producibility and production issues. But, it may not be unrealistic to expect the combat developer to ask two simple questions once the materiel developer has some concept of what is needed:

- Can you make this?

- Can you make a certain number of these by a specified date or within a specified time frame?

The translation of these questions into technical terms can be left to the materiel developer.

It is not TRADOC's responsibility to analyze producibility or production as an engineering science; however, there may be a good case for assigning TRADOC the responsibility to surface these two basic questions early. This could counteract the tendency in both the combat and developer communities to defer discussion of these issues until a fairly well-defined O&O concept is developed. This tendency is contrary to current policy, which encourages the application of early and concurrent engineering. Contrary to some perceptions of the combat developer's roles in the acquisition process, there are a lot of engineering tasks suited for combat developers. Foremost is the need to understand how a product is put together (assembled) and how it can be expected to perform. These understandings are critical to certain TRADOC concerns such as Manpower and Personnel Integration (MANPRINT), which includes human factors engineering, manpower, personnel, training, safety and health hazard assessments. They are equally critical in order to teach every aspect of handling and use -- transport and uncrating, installation, initial and full operation, maintenance, limited rebuild, cessation of operation, repacking, and relocation; each aspect being under potentially adverse environmental and tactical conditions. There was general agreement that it would be reasonable to ask the producibility and production questions before O&O concept generation.

Private Sector Marketing Activities in TRADOC:

Perhaps one of the more important reasons to generate TRADOC interest in producibility and production issues is that many producers feel there are receptive audiences to be found in the combat developer arena. Producers market their products, demonstrate system features and offer capabilities which they would like TRADOC to view as desired solutions. They also offer potential (unsolicited) solutions to unstated requirements in order to stimulate military interest in new product lines. All too often, however, the issues of how many and when -- the producibility and production issues -- are not discussed. Currently, producers look to AMC and, often, to a specific major subordinate command for a particular type of commodity, as

the center of excellence to surface producibility, production and related issues.

Combat/Materiel Developer Working Relationships:

Another issue is the day-to-day working relationships between members of the combat development and materiel development communities. Apparently, there are well-established links between AMC project management offices and TRADOC systems management offices. For early planning, however, the link between combat development offices and the technical base activities in the various MSCs generally appears weak.

As with any endeavor, the successful establishment and maintenance of communications between geographically-separated organizations having different perspectives depends on: 1) the personalities of the individuals, i.e., whether they aggressively force potential issues to the forefront while windows of opportunity are open in order to stimulate an exchange of concerns, before these issues become technical cost and schedule problems, 2) maintaining a strong pace of activity coordination, and 3) understanding and appreciating the other organization's concerns, which must receive attention for programs to be successful.

The impact of these three factors -- personality, coordination, and understanding -- is unpredictable, but it must be taken into consideration in the earliest phases of the program. These factors do influence the consideration of issues such as producibility and production. If these issues are perceived as unimportant until decisions are made to produce, the linkage between the combat and developer communities will remain weak until after programs are fully defined, approved and funded. This situation can be visualized as shown in Figure 3-1, Army Streamlined Acquisition Process, AMC/TRADOC Link.

During the Proof-of-Principle and Development-Prove-Out phases, the Program Executive offices, Project Management offices and TRADOC System Management offices maintain the link, but during the Requirements and Technical Base Activities phase, this linkage either is not formalized or is nonexistent.

ARMY STREAMLINED ACQUISITION PROCESS
AMC/TRADOC LINK

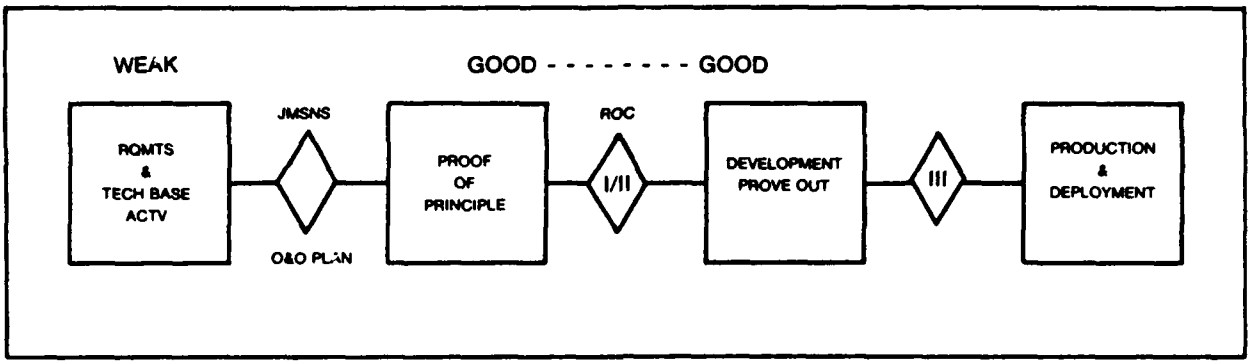

Figure 3-1

Market Investigation Reports:

The new AR 70-1 includes a requirement for market investigation reports, even though there is no requirement to document market surveillance activities which precede market investigations. It is TRADOC's position that documentation of market investigations is needed as part of the ASAP audit trail. Market investigations may continue well into the Proof of Principle phase preceding the Milestone I/II decision point. This is shown in the NDI Adaptation and Tailored Development examples of ASAP tailored programs at Figure 3-2, Army Streamlined Acquisition Process.

Although market investigation data will be available for review, producibility is not separately addressed either by AR 70-1 or by AMC/TRADOC Pam 70-2. Also, although the subject of production receives attention in both publications, an analysis of the information presented therein leaves the reader with the impression that items proposed for acquisition are currently in production. In many cases this may be true, but it should not be assumed. For items which currently are in production, the issues of production capacity, surge and mobilization requirements are covered in the text of the regulation. However, the question of whether desired products are currently being produced, or can be produced with minimal adjustments on the factory floor, is not addressed.

ARMY STREAMLINED ACQUISITION PROCESS

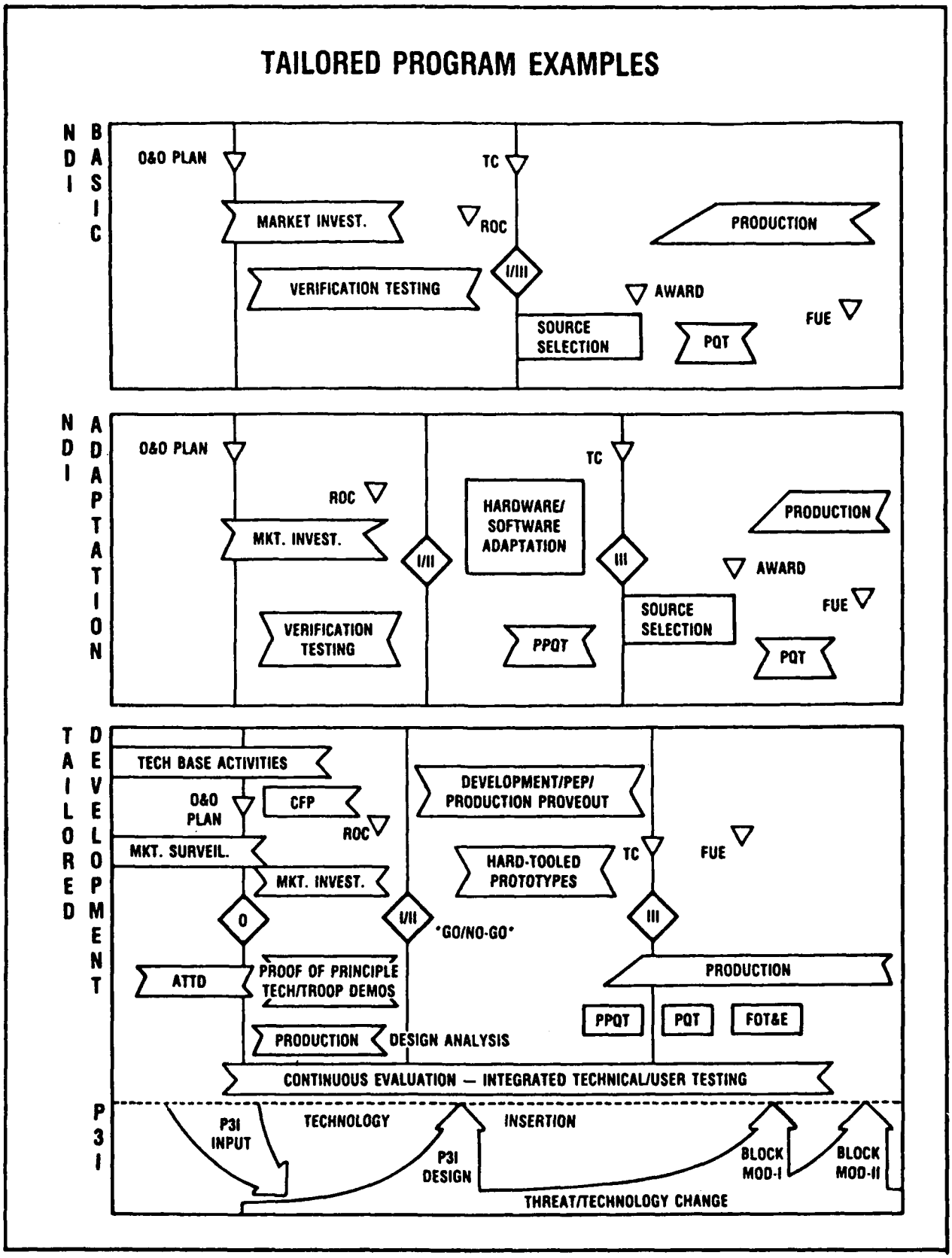

Figure 3-2

Operational and Organizational Plans:

The subject of O&O plans was addressed in conjunction with discussions concerning the market analysis process. Materiel developers may be reluctant to entertain much discussion of new projects until after O&O plans are finalized. This is the "no money, no work" syndrome. The incentive to join forces on an informal basis seems to be missing. One example of such joining of forces is a continual exchange of market surveillance data, which might indicate alternatives to systems being evaluated by a TRADOC proponent center, a possible combination of capabilities offered by two or more alternative systems, or exploratory efforts to identify opportunities for combining capabilities to achieve overall system needs. The feasibility of obtaining data rights or licensing agreements to combine technologies within industry or the Government is another example. This ties directly to potential producibility and production issues. Examples such as these do not begin to cover all possibilities, but they are illustrative and, also, are reasons to focus on specific and total package capabilities to satisfy customer requirements.

Concept Formulation:

There have been some improvements in the overall coordination process. One, highlighted earlier, is the joint AMC/TRADOC Pamphlet 70-2, which provides a common road map for combat and materiel developers to follow. Another document for combat and materiel developer use is Concept Formulation Process (CFP) Memorandum of Understanding, 31 May 1988, which was prepared by TRADOC and jointly approved by the AMC and TRADOC commanders. The products of the concept formulation process became the Concept Formulation Package (also abbreviated CFP). The jointly agreed upon concept formulation processes discussed in AMC/TRADOC Pam 70-2 are:

- Concept Formulation Package (CFP): The documentary evidence that the concept formulation effort has satisfied the objectives. Normally the CFP consists of the TOD, TOA, BTA, and COEA.

- Trade-Off Determination (TOD): The document prepared by the materiel developer. It is sent to the combat developer or to a Special Task Force (STF) or Special Study Group

(SSG) to convey the feasibility of a potential system. Included are technical risks related to each approach, and estimated RDT&E and procurement costs and schedules.

- Trade-Off Analysis (TOA): A document prepared by an STF or SSG, or jointly by the combat and materiel developers, to determine which technical approach offered in the TOD is best.

- Best Technical Approach (BTA): An element of the Concept Formulation Package which identifies the best technical approach(es) for a materiel solution to a user deficiency.

- Cost and Operational Effectiveness Analysis (COEA): A comparative analysis of the effectiveness of alternative means of eliminating or reducing a force or mission deficiency against a defined threat, and the cost of developing, producing, distributing, and sustaining each alternative system in a military environment for a time preceding the combat application. Also, a documented investigation of a valid requirement that HQ TRADOC and HQDA have approved.

All of these CFP activities are normally accomplished before Milestone Decision Review I/II as shown in Figure 3-3, Concept Formulation Process (CFP).

Producibility and Production issues do not receive direct attention during the Concept Formulation Process until the materiel developer begins preparation of the Best Technical Approach part of the Concept Formulation Package, i.e., until after the Milestone O decision point. One of the eight major subjects contained in the BTA, as discussed in the CFP MOU, is:

- Evidence that the approach is engineering, rather than experimental. A producibility analysis should be included.

If the CFP is viewed as a stand-alone document package, then the BTA is the logical document in which to address producibility, after trade off determination and most of the trade off analysis efforts have been completed as shown in Figure 3-3. Although the subject of a

CONCEPT FORMULATION PROCESS (CFP)

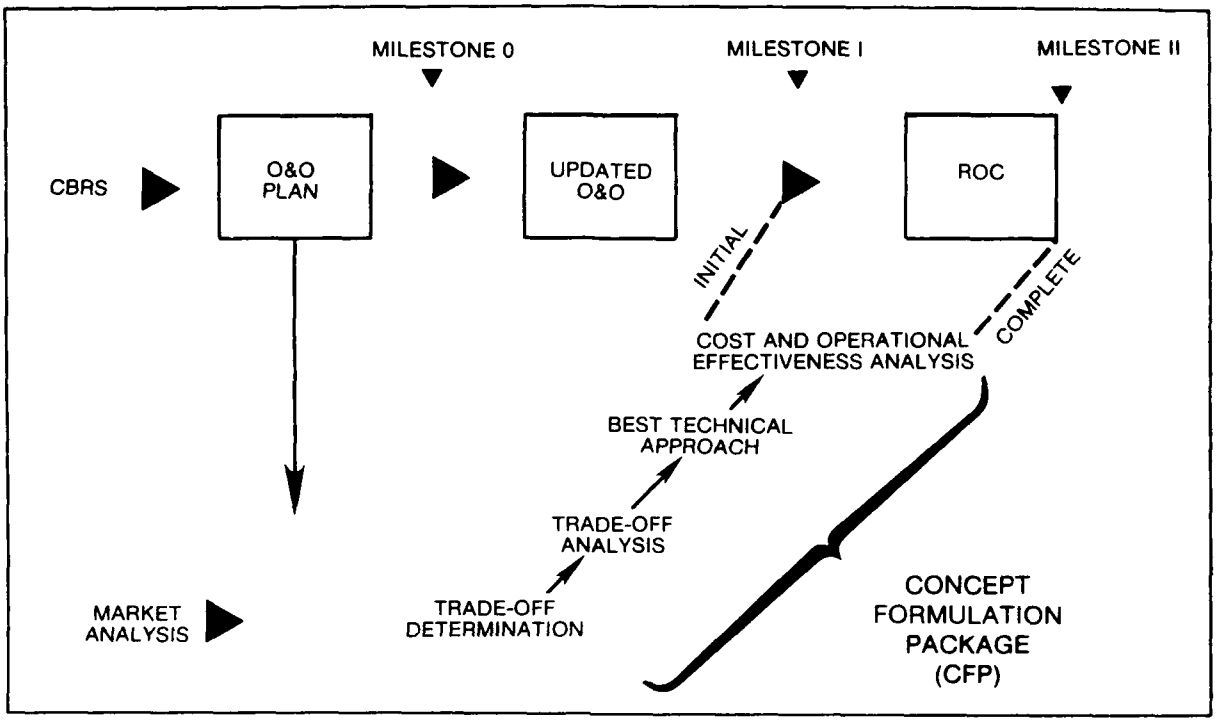

Figure 3-3

producibility analysis is indicated, the timing of its conduct may be too late. Another consideration is the qualifying word "should": this qualification may result in a decision in which producibility considerations might be ignored. If this occurs, programs could be seriously impacted later in the acquisition cycle.

The BTA should present evidence that the technology of the proposed solution is mature enough to support low-to-moderate risk development. This is particularly important within the framework of acquisition streamlining. If producibility is factored into the overall CFP analysis, a low-risk program startup has a much better chance of achieving a low-risk assessment position as it goes into production. In addition, BTAs should show that at least one specific approach can meet user requirements for each acquisition project. If decision makers are locked into a specific project acquisition strategy without any warning of producibility problems once the program moves to a factory floor, this can lead to a series of production traps.

Chronic Problems and Problem Solving:

Discussions at TRADOC included a review of some of the types of problems which must be addressed in order to devise workable materiel acquisition program solutions. Although the heart of the discussions involved underlying concerns for the early exposure of producibility and production considerations, it became apparent that a thorough review could not be confined simply to market analysis activities.

First and foremost, there are too many subsets of process activities which must overlap and interface with market analysis activities to make ASAP work within the relatively brief time frame allotted for it. From a management perspective, this means concurrent program engineering. To make this process successful, and to ensure no one loses sight of the timing and importance of inserting producibility and production considerations into the process, everyone must be able to visualize the entire acquisition cycle from the top down; i.e., to overview the process. They also must be able to exercise sound judgement in determining precisely when to insert program considerations, which include producibility and production. Simply stated, if a person knows where, when, and to what degree an issue fits into the overall process, part of the problem is solved. If the people working each side (before and after) of an issue know how to visualize the overall process, they are better prepared to support problem solving and to act directly on problems. This is the other part of the solution to the problem. If producibility and production issues are brought to the attention of people with the knowledge and experience to treat them in an appropriate manner, they will be dealt with correctly.

Next is the proverbial "not-invented-here" syndrome. There is a natural tendency to nurture in-house solutions and to express pride in one's own accomplishments. Each TRADOC center and school and each AMC MSC or development center is no different in this regard and, as centers of excellence, to act otherwise is to ignore the challenge and pride of winning.

Parochialism, however, is not in the spirit of excellence. The problem is well recognized, but only partial cures are available. One partial cure is to foster -- perhaps force -- early discussions; the maintenance of constant dialogue between combat and material developer communities to continuously explore the best way to obtain the products needed for the Army's

mission. Certainly, producibility and production are issues which need to be discussed early.

Another problem is the desirability and the feasibility of automating market surveillance data bases. Recognizing the fact that requirements identification begins with the combat developer, whereas concurrent technology assessment rests with the materiel developer -- both geographically separated -- there may be justification for automation of market surveillance data and the installation of remote access databases to provide real time sharing of product information. One example is the automated CECOM NDI database, which may be adaptable to other commodities.

A potentially serious problem is a general lack of recognition given to off-shore (foreign/allied) technology. There is a natural tendency to be protectionist; this is the "not-produced-here" syndrome. However, foreign technology is an increasingly critical factor to consider in the overall systems acquisition process. Included are not only the products themselves, but also how they are produced, and whether or not they can be produced here. Critical, too, is the successful integration of foreign and U.S. produced subsystems. The section of this report concerning a visit to the Logistic Management Institute discusses foreign product data acquisition in more depth, to include ongoing efforts to develop a networking capability to access foreign product data.

3.2 U.S. ARMY COMMUNICATIONS-ELECTRONICS COMMAND

General:

CECOM was visited on 28 February and 1 March 1989. CECOM was visited first for two reasons: 1) it acquires a large number of nondevelopmental items, and 2) it is the first AMC MSC to establish a computerized data base to catalog and store product information.

Organizational Structure:

CECOM is organized to accomplish several major activities; research and development, procurement, readiness, reliability and maintenance, all supported by Program Executive Offices (PEOs) and project/product managers. CECOM has undergone a partial reorganization which

has placed the command's producibility and production engineering functions under one centralized authority. The objective is to provide across-the-board support to all elements of the command. Two advantages of this structure are: 1) immediate access to the CECOM commander and his command group for problem resolution and to maintain centralized visibility of planned and ongoing procurements, and 2) continuous overview of the producibility and production aspects of planned or ongoing developmental, product-improved, end item re-buy, and selected secondary item procurements.

To manage this effort, the CECOM Production and Manufacturing Technology (P&MT) Directorate has approximately 500 positions, including approximately 340 engineers. This portion of CECOM is organized into an Office of the Director and nine divisions, as shown in Figure 3-4, CECOM Production & Manufacturing Technology Directorate. Approximately 30 percent of the directorate work force is devoted to support of PEO/PMO functions. In addition to PEO/PMO support, the P&MT Directorate maintains surveillance over approximately 1,000 active contracts.

Within the P&MT Directorate, the data base of producer information is comprehensive and up-to-date for both ongoing and recently closed-out contracts. These contract files provide detailed information concerning all aspects of contractor performance. In many cases, they provide enough data to permit producibility and production engineering-related predictions, should any of these producers offer other products using similar technology and similar manufacturing conditions. However, data on other producers (those which do not hold current contracts) are not always readily available. Since emphasis is placed on current contracts, it is almost impossible to maintain archived data readily accessible for contracts which have long been closed out. Also, much of this older data loses its value as changes occur in product lines, materials, manufacturing technology and business conditions. In this regard, the communications-electronics field also suffers from a "pace-of-technology" problem: electronics is commonly considered a technology with a two and one-half year half-life.

The P&MT Directorate does not use data solely from its active contract files. Other, immediately available resources which are used for current awareness of market conditions and product availability include, but are not limited to: data links with the U.S. Navy; information

CECOM PRODUCTION & MANUFACTURING TECHNOLOGY DIRECTORATE

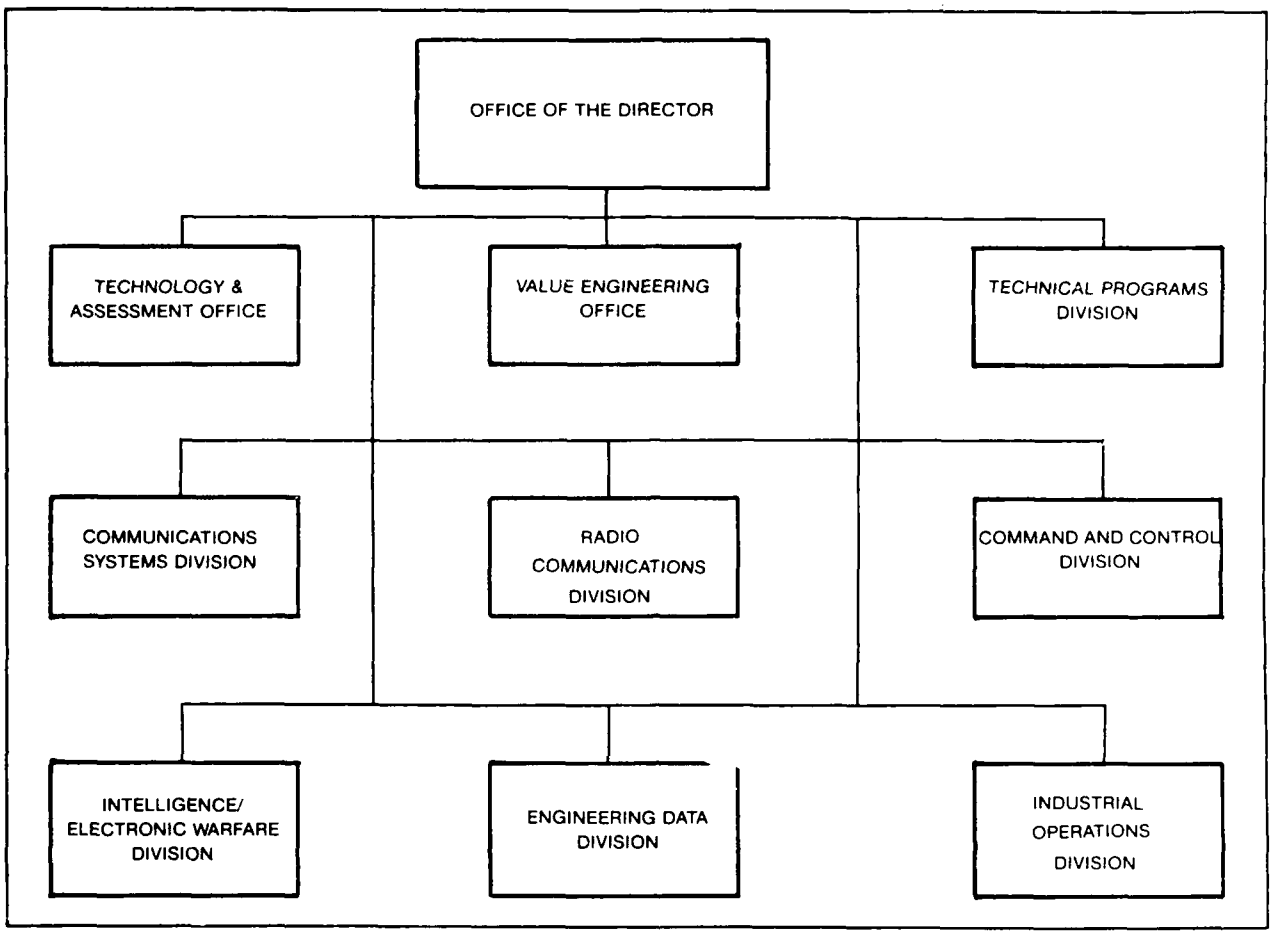

Figure 3-4

from Dun and Bradstreet and the Thomas Register; and other data bases such as Haystack, Parts Master, Dialogue, DTIC and Government supply catalogs.

NDI Database:

The CECOM Center for Research, Development, and Engineering (RD&E) was visited on 1 March 1989. This was done to review the NDI database and to determine if it contained information on producibility and production.

The office of the NDI Advocate within the CECOM RD&E Center has established a computerized NDI database. This is an engineering tool for project managers and project leaders which aids in the quick identification of potential market solutions for military needs.

This database contains resident information on communications-electronics producers and their products, and has access to a multitude of DoD and commercial databases. The concept is as shown in Figure 3-5, NDI Database.

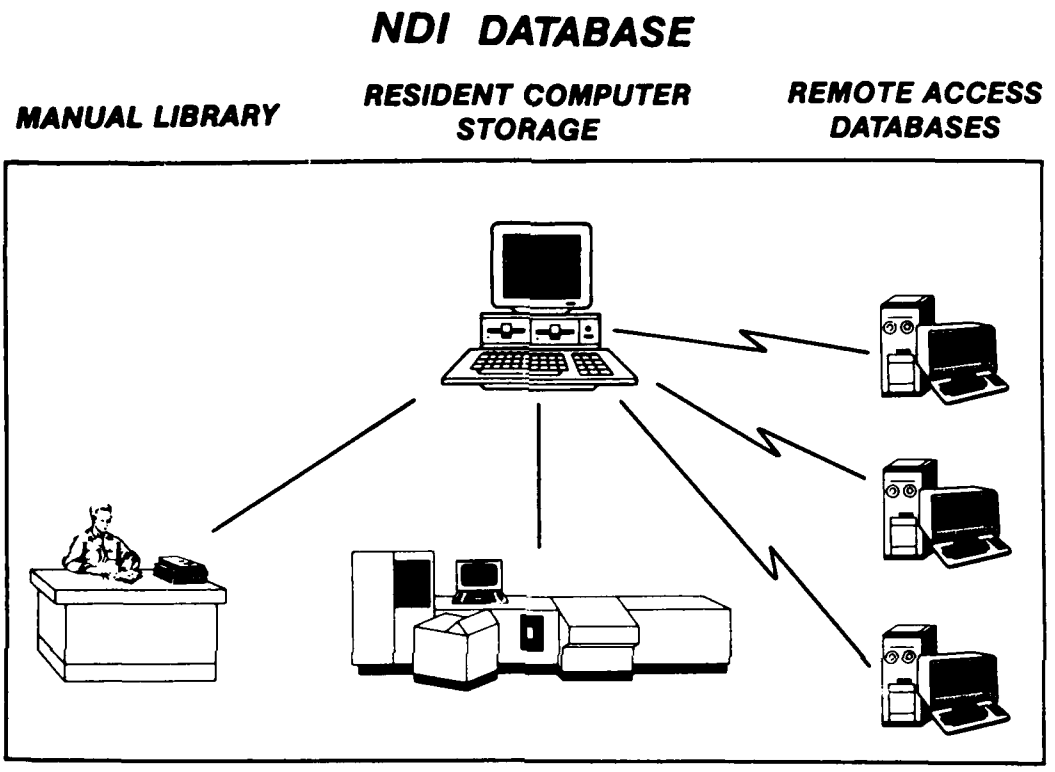

Figure 3-5

The office of the Special Assistant to NDI Acquisition was established to manage the implementation of the NDI database concept. The database organization, consisting of 12 categories with 64 subcategories, is as shown in Figure 3-6, Product Categories.

Vendor listings for the database were solicited through Commerce Business Daily (CBD) advertisements. To date, approximately 6,000 vendors have requested the inclusion of their firm's identification and product lines. Approximately 15,000 products manufactured by these 6,000 vendors are listed. Generally, CECOM believes this level of response represents very good participation. The highly competitive nature of the communications-electronics industry impels most producers to solicit government contract business. The 15,000 product listings are for complete (end item) systems only. No component listings are maintained; this type of data is obtainable from a variety of commercial and government electronic databases and from published catalog sources.

PRODUCT CATEGORIES

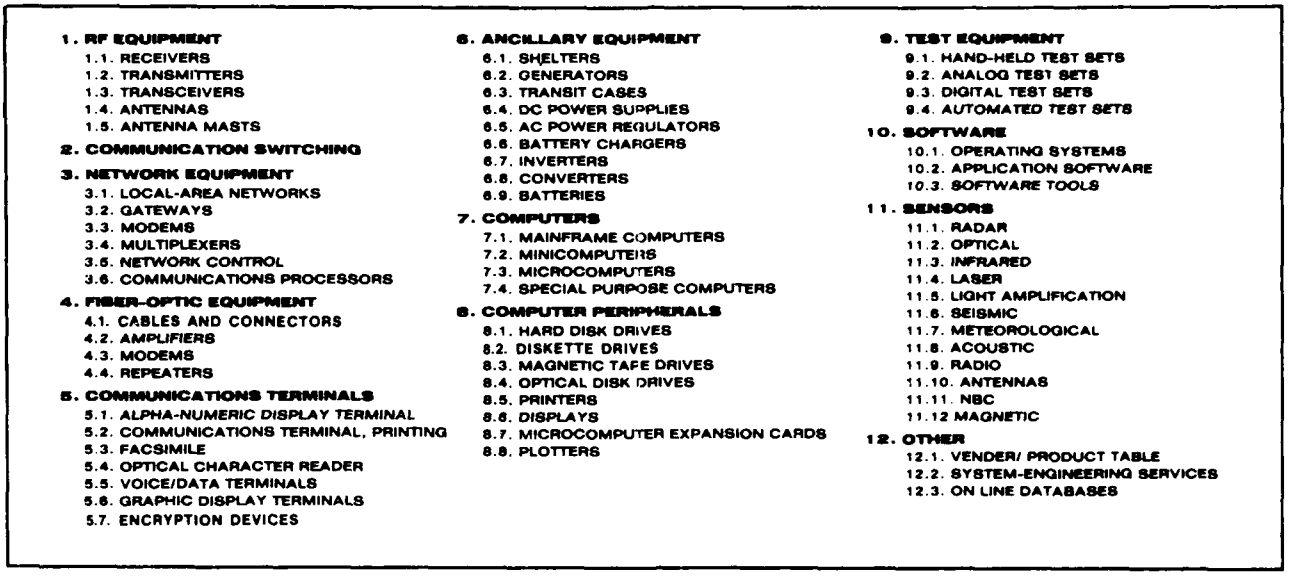

Figure 3-6

Currently, the manual library and resident computer storage portions of the system shown in Figure 3-5 are operational. The remote access databases are planned for installation as resources become available. The objective is to provide a networking capability for outside users such as other AMC MSCs, TRADOC and their proponent schools and centers.

One feature of the NDI database is that it is parametric. A sample of the type of information provided in response to a query is shown in Figure 3-7, Sample NDI Data Base Printout. The query request was for any product information concerning a commercially available, off-the-shelf, single voice channel, frequency modulated (FM) transceiver powered by 24 volts direct current (DC). As shown in the sample print-out, the database provided information for two radios, one produced by Cincinnati Electronics, the other produced by Aselsan. The provided data is limited to identifying the source of supply, the product and important product characteristics. Producibility and production information is non-existent.

SAMPLE NDI DATA BASE PRINTOUT

```
MODE V EXEC y          DATA QUERY SCREEN          F10-RETURN/DN ARROW CONTINUE _
                        1.3 TRANSCEIVER          OUTFILE _ _____ _____ _ _
    VIN_ID 5137336100
     VNAME CINCINNATI ELECTRONICS CORP.
   PROD_ID 580_____              DATE_ENTERED 19870828_____
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
     MODEL HST-4A                    SENS -110 - -122DBM      SELECTIV 0_ ____
   DOCNUMB 626_____                ANT_TYPE                    A/M_ANT
BASE_PRICE 0_____              FREQ_STABIL 1PPM              REMOTE_CTL Y
    WEIGHT 7_____                  OUT_PWR 4_____              TEMPEST
     SIZEH 3    W 7    D 10     MAX_INPUT 0_____             A/D_INTER
INPUT_VOLTS24VDC               NUMB_CHAN 0_____              EMI_RFI
  MIL_SPEC                      SPUR_EMISS                  ORDER_WIRE
APPLICATION                         VSWR 0_____                  EMP
 FREQ_BAND VHF,UHF             MODULATION AM,FM                 ECM  ECCM
  FREQ_MIN 225_____           SET_UP_TIME 0_____           RF_IMPED 0_____
  FREQ_MAX 400_____            CHAN_SPACE 25_____          SN_RATIO 0 _____
FREQ_UNITS MHZ                  INTERMOD 0_____              DUPLEX
      TEXT GUARD CHANNEL - 243 MHZ_____
_____
_____
_____
2 Records received.


MODE V EXEC y          DATA QUERY SCREEN          F10-RETURN/DN ARROW-CONTINUE _
                        1.3 TRANSCEIVER          OUTFILE _____
    VIN_ID 157506
     VNAME ASELSAN
   PROD_ID 1_____                DATE_ENTERED 19870630_____
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
     MODEL RT4600                    SENS .3uV                SELECTIV 60_____
   DOCNUMB 3_____                  ANT_TYPE                    A/M_ANT
BASE_PRICE 0_____              FREQ_STABIL ?                 REMOTE_CTL
    WEIGHT 0_____                  OUT_PWR 30_____             TEMPEST
     SIZEH ?    W ?    D ?      MAX_INPUT 0_____             A/D_INTER
INPUT_VOLTS24VDC               NUMB_CHAN 1840_____           EMI_RFI
  MIL_SPEC                      SPUR_EMISS                  ORDER_WIRE
APPLICATION                         VSWR 0_____                  EMP
 FREQ_BAND VHF                 MODULATION FM                    ECM  ECCM
  FREQ_MIN 30_____            SET_UP_TIME 0_____           RF_IMPED 50_____
  FREQ_MAX 76.0_____           CHAN_SPACE 25_____          SN_RATIO 0_____
FREQ_UNITS MHz                  INTERMOD 0_____              DUPLEX
      TEXT output power is 2.5W without AM4600 amplifier_____
_____
_____
_____
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Figure 3-7

This limitation may or may not be appropriate for this type of a database. One of the actions planned by CECOM is to request updated information from vendors on an annual or semi-annual basis in order to revalidate the listings. If this annual or semi-annual revalidation procedure is accomplished, and if manufacturers support the revalidation process, additional data items such as "currently in production", "planned production rate" (over a specific time frame, e.g., 6 or 12 months), and "length of production" information could be included by format additions. Before this is done, however, two factors may need further examination: 1) producers may be reluctant to provide much production data; they tend to jealously guard their rights to change product specifications without notice, stop production of one or more products, and start production of new products, and 2) the collection and continuous updating

of this data may be of negligible value because producibility and production concerns need to be discussed with potential producers in order to verify their current status before efforts are initiated to perform market investigations.

Nondevelopmental Item Acquisition:

CECOM has prepared a new Pamphlet 70-6, Nondevelopment Item Acquisition Guide (planned for release in June, 1989) which contains 30 chapters of valuable information for NDI planners. Although portions of the text material are oriented to communications-electronics and the CECOM organization, the preponderance of information is generally applicable to all military activities involved with NDI acquisitions, regardless of the commodity. After the initial distribution of this pamphlet is completed, copies may be obtained through DTIC, Cameron Station, VA.

The following major subjects are given comprehensive coverage in the new pamphlet: NDI acquisition cycle description and activity responsibilities; resources, milestones and program documentation; market surveillance and investigation; the NDI database and the International Materiel Evaluation (IME) Program; acquisition strategy and planning, independent evaluation plans and reports; and the software acquisition policy.

The new pamphlet addresses producibility and production considerations in several ways. First, as an NDI consideration, market investigations must assess a manufacturer's history, production capability, and ability to sustain support over the intended life cycle of the product. Second, the CECOM Director of Production and Manufacturing Technology is included in the Materiel Acquisition Review Board (MARB) process, but not until milestone III, when the decision is made to produce. Third, project management offices prepare market investigation questionnaires, with assistance from the NDI Advocates' office, and the Directorate for Production and Manufacturing Technology is tasked to participate in market investigations. (It is assumed that, with P&MT participation, producibility and production concerns are addressed).

Primary sources of market surveillance data include site visits and discussions with industry representatives. Market investigations are conducted for funded programs which are

not sole source. TRADOC and independent evaluators are active participants. Sample MI questions provided in pamphlet 70-6 address producibility and production, but it is emphasized in the text that MI questions are tailored to the type of acquisition program. Four sample questions which address these concerns are:

- Are there suitable products available in sufficient quantities to meet the Army's requirements, in both peacetime and wartime, without unique or separate production runs?

- Are there support systems, including parts and backup capabilities, that satisfy the Army's needs for the life of the system? If not, this may lead to a one-time buy to support the product?

- Do vendors making the NDI have good product quality and product support histories?

- Industry related questions such as: size and location of manufacturers; production capacity to meet Army requirements as part of commercial sales and appropriate time to buy; and average time between model changes and the practice of providing continued parts inventories or production for phased-out models.

The acquisition strategy includes a requirement to address manufacturing, production, and quality extracted from the new pamphlet 70-6.

Figure 3-8, The Army Streamlined Acquisition Cycle with NDI Implications (Partial), which is extracted from the new Pam 70-6, illustrates the CECOM approach to early activities that need to be undertaken by both the combat and materiel developers for a successful NDI acquisition program. This approach recognizes the need for early interaction to address all possible issues including producibility and production concerns. As a start, the materiel developer is feeding input from the technical base into the combat developer while the O&O plan is being drafted. This provides the needed opportunity to inject comments and express concerns regarding potential producibility and production issues.

THE ARMY STREAMLINED ACQUISITION CYCLE WITH NDI IMPLICATIONS

(START OF CYCLE THROUGH MARKET INVESTIGATION PHASE I)

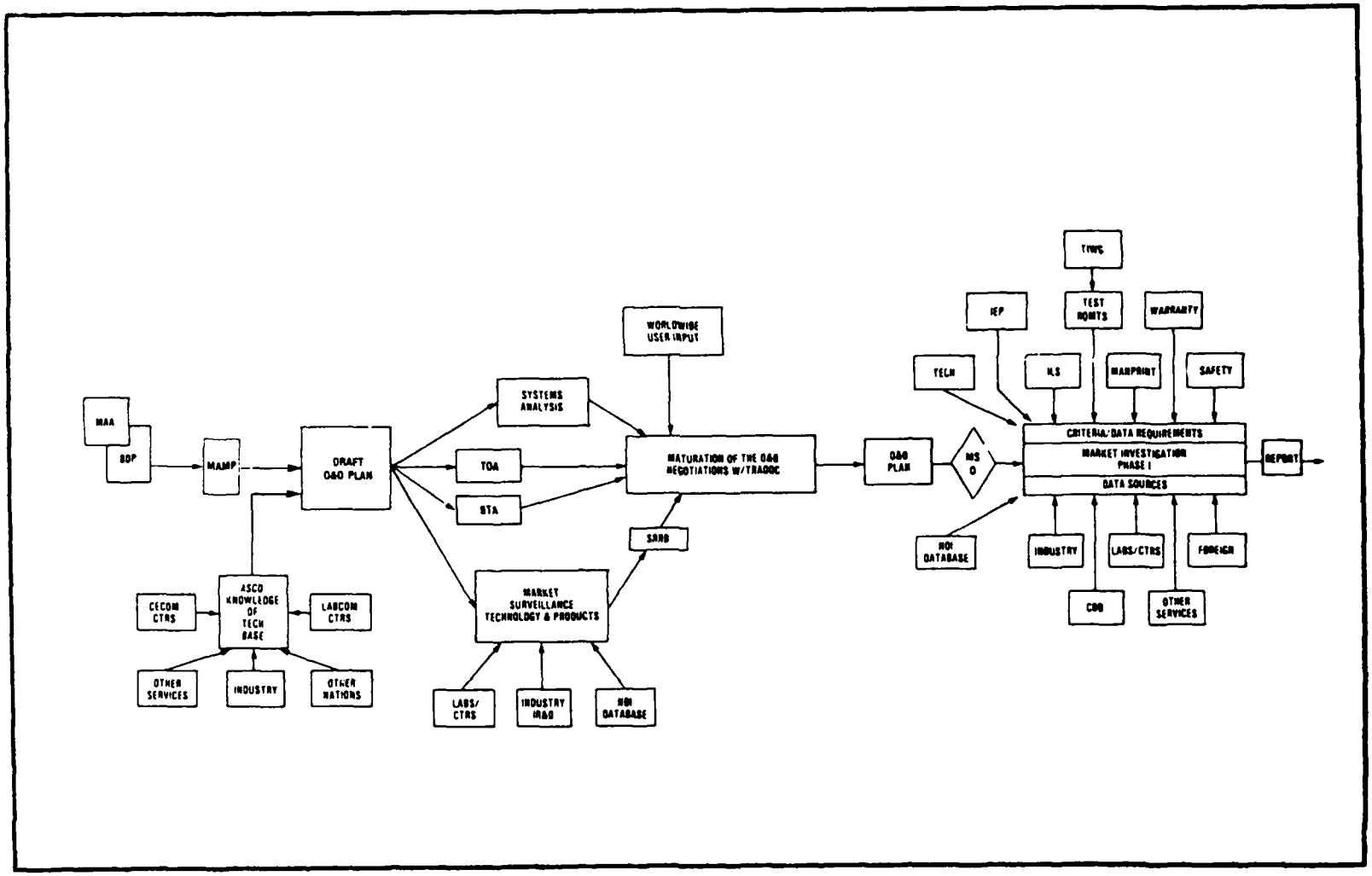

Figure 3-8

Following preparation of the draft O&O plan, two more opportunities become available. Development of the Best Technical Approach portion of the Concept Formulation Package is the first of these two opportunities. The BTA is the CFP document which includes discussion of producibility and production issues. Market surveillance activity, done concurrently with work on the BTA, is the other early area where producibility and production concerns, surfaced during draft O&O plan preparation, can influence the selection of candidate producers. The entire Army Streamlined Acquisition Cycle with NDI Implications is reproduced in the new pamphlet.

3.3 U.S. ARMY SIGNAL CENTER AND SCHOOL

General:

The Army Signal Center and School was visited on 8 March 1989 to obtain firsthand information concerning communications-electronics combat development activities; the interface between the Directorate of Combat Developments, TRADOC System Manager (TSM) activities; its AMC MSC materiel developer counterpart; how the Signal Center functions as part of the market analysis process; and to what extent the issues of producibility and production are addressed.

Organizational Structure:

The U.S. Army Signal Center and School was formed in 1974 by consolidating the existing Southeastern Signal School (Fort Gordon, GA) and the Signal School (Fort Monmouth, NJ) at Fort Gordon, GA. Presently, Fort Gordon is the largest communications-electronics facility in the free world; it trains more soldiers than any other branch training center of the U.S. Army. The TRADOC System Management Office and the Directorate of Combat Developments are part of the Signal Center portion of the command. The basic relationships between the combat and materiel developers are shown in Figure 3-9, Organizational Relationships.

The definitions extracted from AMC/TRADOC Pam 70-2 for combat developer, materiel developer, system manager and project manager reflect the counterpart relationships illustrated in Figure 3-9. These definitions are:

COMBAT DEVELOPER

(CBTDEV)

Command or agency that formulates doctrine, concepts, organizations, materiel requirements and objectives. Represents the user community in the materiel acquisition process. This includes system for retail level logistics support, primarily for Army forces in a theater of operations.

MATERIEL DEVELOPER

(MATDEV)

Command or agency responsible for research, production and production validation of a system (including the system for its wholesale level logistics support) which responds to HQDA-approved materiel requirements.

TRADOC SYSTEM MANAGER

(TSM)

Appointed by the CG, TRADOC for selected major and nonmajor materiel acquisition programs. The TSM is appointed shortly after the beginning of a program or about the same time as the AMC Project Manager. The TSM manages all facets of user input and user actions throughout the development, production, and deployment of an assigned system.

PROGRAM/PROJECT/PRODUCT MANAGER

(PM)

Individual chartered to conduct business on behalf of the Army, who reports to the materiel developer or to the commander of a subordinate organization as designated by the materiel developer. The PM is assigned the responsibility and delegated the full-line authority of the materiel developer for the centralized management of a specified acquisition program.

ORGANIZATIONAL RELATIONSHIPS

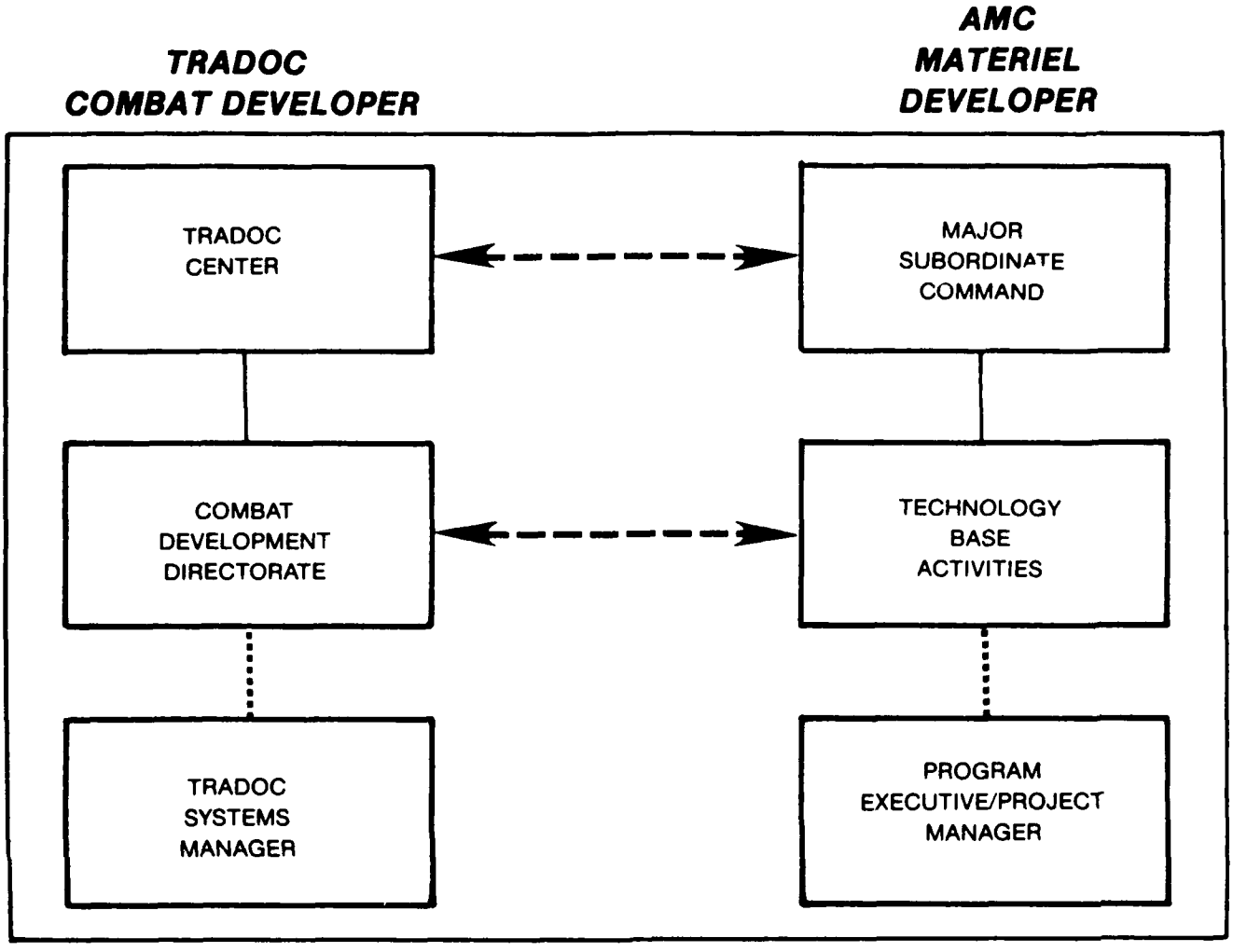

Figure 3-9

Producibility and Production Issues:

Generally, the Signal Center does not directly address the issues of producibility and production. These issues are considered only on an indirect basis. Indirect involvement generally focuses more on technology and affordability issues. As a center of academic and analytical excellence in the field of communications-electronics, the Signal Center has an inherent awareness of the state-of-the-art of these technologies which are readily available, potentially available in the near term, or potential scientific breakthroughs.

The affordability issue concerns the ultimate unit cost for products. The Signal Center is aware of the fact that technology and producibility issues are linked, and that production costs rise in some proportion to the level of technology mandated for products. The center

emphasizes ASAP and NDI as viable alternatives to save time and money.

Signal Center TRADOC Systems Managers:

During visits with representatives of the six TSM offices at the Signal Center, questions were asked concerning involvement with producibility and production issues, knowledge of the market analysis process, and the CECOM NDI database. There was a full range of responses. In one instance, an action officer indicated no awareness of the subjects; in a second instance, there was an excellent knowledge of user concerns and current requirements, but little or no direct involvement in the areas of producibility or production, and no knowledge concerning the CECOM NDI database; in a third instance, there was an excellent knowledge of NDI acquisitions, domestic and off-shore acquisition considerations, the intense degree of cooperation needed with materiel developers, and an awareness of the CECOM NDI database. In one of these instances, the officer had only recently moved into a TSM office from an overseas assignment; he was devoting most of his available time to analysis and review activities of user needs, traveling extensively to Army organizations in the United States and overseas. During this period, little or no time had been available to address issues such as producibility and production. In another instance, the individual had extensive dedicated experience with a major NDI acquisition program dating back at least to 1980.

The six TSMs at the Signal Center are fairly representative of all TRADOC TSMs. Much of their activity will have at least an indirect impact on producibility and production; however, there is probably little up-front recognition of this influence. In this regard, points worth considering are:

- TSMs travel extensively. In the U.S., they visit other proponent schools (systems integration/interoperability/unique needs/total requirements); operating commands (user evaluations and requirements); test activities (all facets of engineering and user testing); overseas (unique problem issues such as host country interoperability/standardization and operational restrictions, specific problem needs and total requirements); TRADOC headquarters (coordination and staffing of requirements and funding/scheduling issues); AMC major subordinate commands (participation/reporting on technology and operational needs, coordination of funding rescheduling issues, and participation in decision making); National

Guard and Reserve organizations; and other U.S. services (coordination of joint service needs).

- Travel and constant exposure to users make the TSMs about as close to requirements as anyone can get. This helps them to identify total system needs, operational environments, qualitative operator/maintainer skills, and logistics needs.

- It is not part of the TSM's job to worry about producibility and production. However, as information is collected and analyzed to identify actual needs (to eliminate the "gold plating") for improved or new capabilities, the TSM should pass this information to the appropriate AMC MSC. The MSC producibility and production engineering staff personnel should review this information in order to help advise, guide and directly assist combat development and system management activities.

Because of travel and other requirements, TSMs are frequently away from their offices. It is almost impossible to meet with all of them at any one time, and the six Signal Center TSMs are no exception. However, one TSM and a deputy TSM were available for interviews during the visit.

TSM, Combat Net Radio:

The first TSM visited was the TSM, Combat Net Radio (CNR). His office has responsibility for combat development management of several projects including the Single Channel Ground/Airborne Radio System (SINCGARS), the Improved High Frequency Radio (IHFR), Battlefield Electronic Communications-Electronics Operating Instructions (BECSS), Short Term Anti-Jam (STAJ) program, the Miniature Terminal (MINTERM) portion of the Advanced Narrow Band Digital Voice Terminal (ANDVT), Squad Level Radio (SLR), Quick Antenna Extension Mast Kit, and other related projects. The basic components of the SINCGARS system shown in Figure 3-10 are examples of systems managed by the TSM, CNR.

The TSM, CNR was not able to identify any direct involvement with producibility or production. He had not been a TSM long enough to discuss SINCGARS start-up production problems. Some of his comments do, however, have indirect connection to both subjects. Vendors visit him and present opportunities for discussion concerning their capabilities to

produce volume quantities of new product offerings, products or product portions (end item subassemblies) currently in production, on-hand inventories, lead times to produce and deliver, and life cycle support issues. Data and literature provided by vendors are normally retained and, if judged of potential value, they are passed to the Directorate of Combat Development (DCD) for further analysis.

As part of regular TSM responsibilities to survey users for needs, identified requirements also are passed to DCD. The TSM, moreover, discusses program issues with his counterpart AMC project manager (PM, SINCGARS) on a day-to-day basis, and has occasional discussions with TRADOC headquarters. Obviously, the channels of communication are open and the opportunities are continually present to share producibility and production concerns as they arise. The TSM is involved routinely with Operational and Organizational planning and Required Operational Capability planning. Draft O&O planning activities present some of the best opportunities to discuss potential producibility and production issues with the materiel developer, particularly before the material developer prepares the Best Technical Approach (which also addresses these issues).

SINGLE CHANNEL
GROUND/AIRBORNE RADIO SYSTEM (SINCGARS)

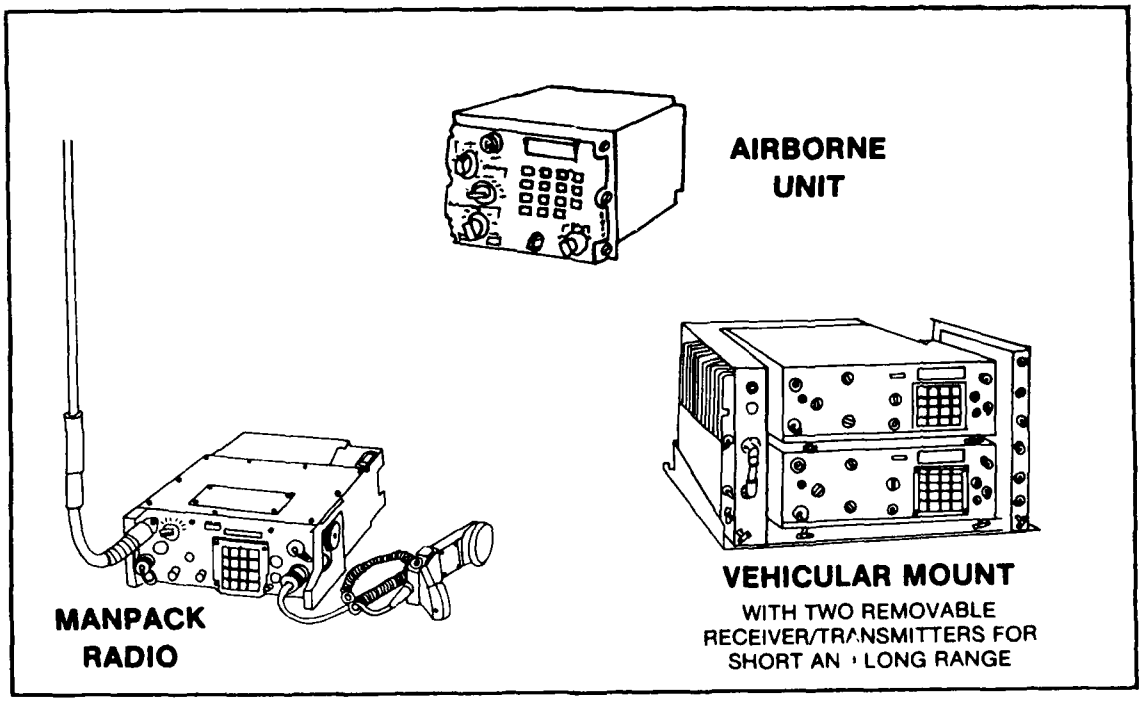

Figure 3-10

TSM, Mobile Subscriber Equipment:

The next office visited was that of the Deputy TSM, Mobile Subscriber Equipment (MSE), to discuss the producibility and production aspects of market analysis. A portion of the MSE is shown at Figure 3-11.

The deputy TSM had been with the MSE program since its inception and the system is a good example for study as an NDI project.

MSE is a nondevelopmental item, modeled after the Thomson CSF-produced RITA system fielded to the French armed forces in 1983. Basically, RITA and the U.S. Army MSE are automatic integrated transmission and switching systems. The system employs digital transmission and switching, and automatic search and routing for fixed and mobile subscribers. Automatic communications routing is done by systematic flood search. MSE provides mobile, protected, and flexible network communications, structured around three sub-assemblies which are adaptable to various tactical situations. The first sub-assembly is the basic meshing element organized around a digital switch. The second sub-assembly is the connecting group,

MOBILE SUBSCRIBER EQUIPMENT (MSE)

MOBILE SUBSCRIBER RADIO TERMINAL (MSRT) PORTION OF MSE SYSTEM

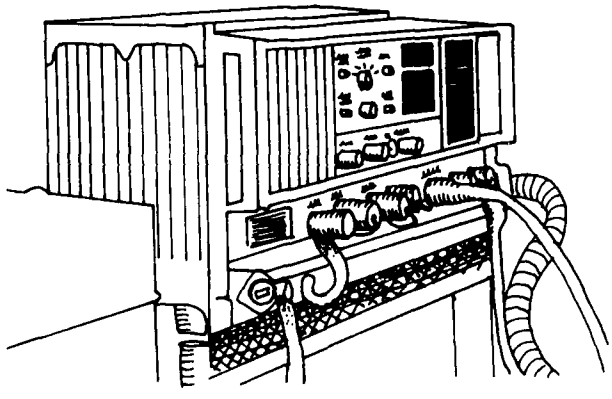

Figure 3-11

intended to connect system subscribers to each other by VHF single channel radio or by microwave links. The third sub-assembly is the mobile subscriber set, which allows users to be automatically connected while moving.

The U.S. Army MSE system is produced in the United States by General Telephone and Electronics (GTE). Although MSE is functionally similar to the French RITA, the U.S. version will have a considerably larger capability for network coverage than RITA, which was originally conceived as a smaller scale, corps and division-level command and control network. The MSE system represents an investment of approximately 4.3 billion dollars for hardware and associated logistics support to equip active, National Guard and Army Reserve tactical organizations.

The operational concept was a tactical version of a "Ma Bell" (commercial telephone) switching system, extended to include a cellular radio telephone capability. This commercial technology captured high-level interest and became an initiative driven from the top down. Most of the elements favoring a decision to conduct market investigations were present at the beginning of the program:

- Cost: Any program with a price tag of billions of dollars is going to receive a lot of visibility, i.e., the affordability issue.

- Competition: All elements were present; ongoing U.S./Allied studies, possible domestic production contenders, and foreign allied development programs.

- Technology: Available, certainly for command and control at the Division level.

- Militarization: In some cases, equipment already had been demonstrated as acceptable for use in most, if not all, military environments.

- Commercial Application: The concept already was in use in cellular telephone systems.

- Producibility and Production: These probably were not serious issues.

At Fort Monmouth, where most of the Army's communications-electronics research and development work is done, the TRI-TAC (joint service) office was studying ways of accomplishing tactical network switching, but its approach appeared to be unaffordable. Cost and the need to solve the switching problem precipitated the establishment of a Special Task Force (STF) to explore alternative approaches. U.S. firms such as Harris, RCA and Raytheon were visited. Offshore visits also were made to the United Kingdom, France and West Germany.

Fortunately, an early, goal-oriented working relationship was established between the combat developer (TRADOC Signal Center) and the materiel developer (CECOM) communities. Producibility issues were addressed early, although a CECOM technology assessment was less optimistic. When this assessment was prepared, indications were that the required technology was not available to meet the need. One example was the TRI-TAC contractor who was running into problems with five-watt output transistor production. The reject rate was running 60 percent. Only a limited amount of R&D work had been done in the 1978-80 time frame. There was not much to go on in terms of producibility. Much of the R&D work was not invested in ruggedization; it concentrated more on the issue of downsizing (repackaging).

There also was an issue about domestic production. If a foreign system was to be adopted as the preferred candidate, emphasis had to be placed on developing a domestic production capability. No matter what system was selected, it had to be considered as a basic, and probably critical, element of the Army's total move, shoot and communicate mission. The decision to adopt the French, Thomson CSF-produced, RITA design and, with some changes, redesignate it as the MSE, elevated concerns for these problems to the forefront. It became apparent that MSE would not be solely a U.S. produced product.

Competitive teaming pitted a Rockwell (US) and Plessy (UK) team against a GTE (US) and Thomson (FR) team. These two teams were proposing to build a system against a Request for Proposal (RFP) that was stripped of all original specifications and standards. Essentially, the RFP became a functional (requirements oriented) solicitation. This would appear to be the proper (i.e., textbook solution) to an NDI acquisition program; however, the U.S. needed a somewhat greater capability for networking than was then offered by the existing French RITA design. By literally stripping the solicitation, the long term effects were that a

multi-million dollar Value Engineering Change Proposal (VECP) cycle was necessitated to incorporate the needed network control enhancements. This immediately surfaced potential microprocessor producibility and production concerns.

The prime contract to produce the MSE was awarded to GTE. GTE was the product assembler and integrator, not the manufacturer of all the components in the system. Serious production problems occurred as work got underway with portions of the MSE. Two of the more significant problems were: 1) the British had line of sight (LOS) radio production problems which were not overcome until after the effort was transferred to Canadian Marconi, and 2) the Mobile Subscriber Radio Terminal (MSRT) effort was transferred from Thomson CSF (FR) to Gould (US), which subsequently filed for reorganization under Chapter 11 of the Bankruptcy Act. GTE then was compelled to consider an alternative domestic producer to preserve some percentage of the work as being sourced in the U.S.

One of the good things to happen during the MSE program, in addition to developing a strong cooperative working relationship between the combat and materiel developers, was to collaborate in the Source Selection Evaluation Board (SSEB) process. After both sides of the development community (AMC/TRADOC) joined together in this process, both sides became aware of all the issues, including producibility and production.

3.4 U.S. ARMY TANK - AUTOMOTIVE COMMAND

General:

The Tank - Automotive Command was the second AMC Major Subordinate Command visited to discuss producibility and production aspects of the market analysis process. The two-day visit started on 21 March 1989 with an informal briefing and round table discussion with representatives of the TACOM Research, Development and Engineering (RDE) Center, the Production Division and the Program Executive Office, Combat Support. The purpose of this meeting was to overview TACOM's involvement with producibility and production concerns during the early part of the acquisition process (e.g., market analysis) and during the production phases of TACOM-managed systems.

Organizational Structure:

An overview of the TACOM organizations engaged in market analysis activities is shown at Figure 3-12, TACOM Market Analysis Linkage. It illustrates the linkages between R&D, the two Program Executive Offices for tracked and wheeled vehicle systems, and the Production Division.

The RDE Center Directorate for Design and Manufacturing Technology has the producibility mission. Part of this mission is to manage Manufacturing Methods and Technology (MM&T) programs, Value Engineering (VE) programs, producibility programs and the metallurgical analysis laboratory. TACOM views producibility as "bridging the gap" between RD&E and Production. The "bridging" occurs by successful implementation of the Producibility

TACOM MARKET ANALYSIS LINKAGE

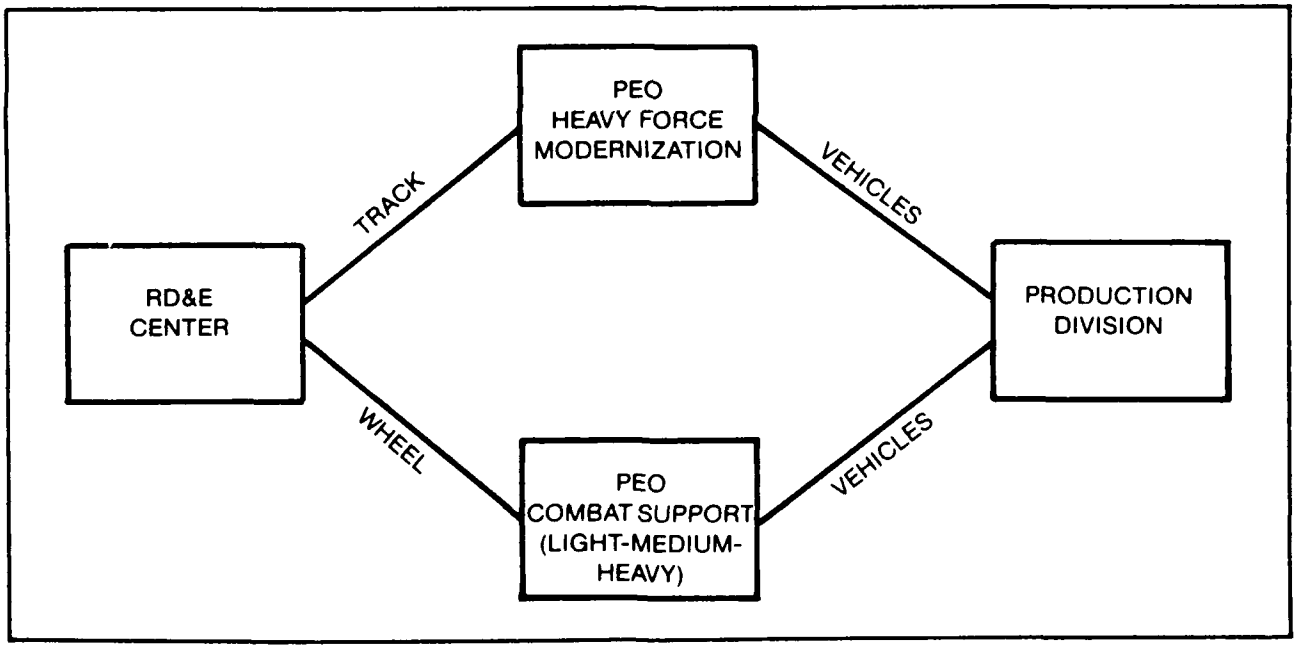

Figure 3-12

Engineering and Planning (PEP), Manufacturing Methods and Technology (MM&T), and Value Engineering (VE) programs. The functional activities which the PEP, MM&T and VE programs "bridge" include design, fabrication and assembly, manufacturing technology, quality assurance and facilities. Within the RDE Center, producibility concerns generally are addressed by the Technology Directorate, the Advanced Systems and Planning Directorate, the Engineering

Directorate, and the Design and Manufacturing Directorate (which includes the Manufacturing Technology and Producibility Division).

Approach to Productivity and Production:

TACOM assesses production feasibility early in the Requirements and Technical Base phase. One or more updates to this assessment are prepared before Milestone I. An initial Producibility Engineering Analysis also is prepared before Milestone I. TACOM considers early production feasibility assessment to be very important in order to determine if:

- Various potential design concepts can adequately satisfy system functional criteria.
- Required manufacturing technologies are available for engineering prototyping.
- Design and manufacturing characteristics of new materials are available for advanced prototyping.
- Alternate design approaches within each potential concept are possible.
- Estimated risks that the selected design will simultaneously meet technical performance, quality, production rate, cost and schedule requirements are acceptable.

Approximately two years ago, the TACOM RDE Center's Advanced Systems Concepts Planning Office established a Mission Area Proponency Branch staffed with military R&D Coordinator Officers (formerly TRISOs - Technical Requirements Integration Staff Officers) to provide active in-house links with the TRADOC proponent centers. These officers are involved with the exchange of technology information among their respective TRADOC Centers. They participate in the generation of requirements documentation, and serve as TRADOC liaison between the Centers, the PEOs, and the procurement, production and materiel fielding activities. One advantage of this arrangement is the real time coordination between the combat and materiel developer. Another advantage is "green-suit" exposure. The main benefit to the military personnel assigned to these positions is the opportunity to gain firsthand views of the

materiel developer's role in the R&D and acquisition processes. By this means, the reasoning behind materiel developer concerns such as producibility and production is better understood.

TACOM Market Analysis Approach:

TACOM market analysis information is generally received in response to requirements (normally TRADOC generated). It flows into two Program Executive Offices, one of which is for tracked vehicle systems, the other for wheeled vehicle systems. The PEOs draw on RDE Directorate resources for policy and procedural guidance in the conduct of market analysis surveillance/investigation activities, and for technology base and engineering support. The PEOs also draw on Production Division resources for data concerning current producers. Normally, the PEOs develop the industry questionnaire packages and the recommended Commerce Business Daily insertion information. TACOM's procurement office distributes the packages to industry.

TACOM's production responsibilities are assigned similarly. Within the RDE Center, the Design and Manufacturing Directorate has the lead for production. Both PEOs also have production engineering management responsibilities. The Deputy Commanding General (DCG) for Readiness assigns production responsibilities to the Procurement and Production Directorate and to the Product Assurance and Test Directorate. One of the advantages of these assignments of responsibility is that R&D, program management and production personnel can actively participate in the resolution of producibility and production-related concerns and issues.

For TACOM, the market analysis process has advantages and disadvantages as shown in Figure 3-13, Market Analysis Activities.

TACOM Market Surveillance Database:

TACOM's surveillance database is not computerized. Consideration has been given to the feasibility of establishing a more automated type of database, but a lack of personnel and funding resources precludes an active effort in this area. TACOM still refers to the surveillance/investigation processes as market surveys. Surveillance was expressed as a "flexible exchange of ideas", and as much less formalized than actual surveillance.

MARKET ANALYSIS ACTIVITIES

MARKET SURVEILLANCE

ADVANTAGES:

- RELATIVELY QUICK (1-2 MONTHS)
- BROAD IN NATURE, PROVIDES MANY ALTERNATIVES
- INFORMATIVE

DISADVANTAGES:

- NOT ALWAYS COMPLETE
- FOCUSES ON WHAT IS AVAILABLE TODAY, NOT TOMORROW
- DOES NOT INCLUDE MISSION OR OBJECTIVE INFORMATION
- DOES NOT TALK MONEY
- LITTLE OR NO USER INPUT

MARKET INVESTIGATION

ADVANTAGES:

- USER INPUT PROVIDES INDUSTRY WITH O&O PLANS AND SPECIFIC QUESTIONS
- ALLOWS INDUSTRY TO PROVIDE SPECIFIC INFORMATION AS TO WHAT THEY HAVE & WHAT THEY COULD HAVE
- ALLOWS FOR SOME COST ESTIMATING
- PROVIDES DEVELOPERS WITH ANSWERS TO SPECIFIC QUESTIONS

DISADVANTAGES:

- TIME CONSUMING (6-9 MONTHS)
- NOT ALL CONTRACTORS ARE RESPONSIVE

Figure 3-13

Information on potential producers is available but, for the most part, is manually filed. However, there does appear to be considerable TACOM awareness and interest in current producers' capabilities and their product lines.

TACOM Market Surveys:

The TACOM approach emphasizes the application of industry-sector searches for each type of potential procurement, i.e., advertising in the Commerce Business Daily and questionnaire packages to prospective bidders. Market surveillance data is an important source of information, but appears to be less important than at CECOM. The TACOM market survey packages (part of market investigation activities) are designed to encourage and solicit industry responses. These packages consist of questionnaires and information concerning four subject areas:

- A description of program requirements (schedule, quantity, major provisions).
- The performance specification.
- Testing program information.
- A description of the operational scenario.

The replies to these package questionnaires are analyzed: 1) to determine if technical requirements reflect state-of-the-art technology, 2) to determine if the proposed schedule inhibits competition, and 3) to help TACOM develop procurement strategy. Appendix B contains a copy of a recently-distributed TACOM questionnaire which serves as a good example of the type of informatio.: industry is requested to provide.

TACOM Resources:

Throughout the visit to TACOM, two points invariably were discussed:

- The subjects of ASAP, NDI, market analysis, producibility, production, coordination, and combat/materiel developer relationships are well understood. A willingness to aggressively pursue these subjects is apparent.

- Resources are inadequate to give these subjects the attention and emphasis they deserve.

Lack of resources was presented as the number one issue, and several examples were discussed to explain the reason for this concern. One of these examples concerns the Industrial Preparedness (IP) Branch of the Production Division. Currently, one Captain and one civilian employee (two positions) maintain a manual database of vendor information to respond to requests for market survey information. According to data provided during the visit, for the first part of 1989, 162 requests for survey information were received and processed by the IP Branch for mailing to industry, and 605 responses from industry were received and processed. Neither of these two positions has been funded since 1984.

This resource problem was highlighted as a principal reason for the lack of study and implementation of an automated or semi-automated database for market surveillance data. Manual procedures (file drawers) are viewed as cumbersome and labor intensive for retrieval of surveillance data. However, other resources within the Production Division cannot be diverted easily to reinforce the Industrial Preparedness Branch. For example, the Readiness Branch is involved with approximately 275 major items of equipment, 2,500 secondary items, and numerous Technical Data Packages (TDPs) with almost 600,000 drawings, and has centralized responsibilities for Pre-Award Surveys.

Another example concerns the Mission Area Proponency Branch. TACOM has started work on the Army Heavy Force Modernization (HFM) Program. Military personnel from the Mission Area Proponency Branch had to be reassigned to the HFM program, which severely weakened the TACOM in-house link with the TRADOC Centers.

Other TACOM Issues and Concerns:

During a discussion concerning databases and automation, one TACOM question was: Does CECOM's database include subcontractors who won't go direct to the Government, but will go to prime contractors? (CECOM does not solicit vendor information on this basis). Another question was: Has CECOM done anything about automating their current production contract database? The TACOM thought was that this type of data might prove useful to other

AMC MSCs, other military services or other Government agencies. (CECOM has not automated their production database).

The database discussion led to the subject of communications. TACOM comments were that remote terminal access to these databases could be one important way of improving communications. In general, communications are viewed as weak.

The subject of production generated a comment about Producibility Reviews (PRs) and Production Readiness Reviews (PRRs). TACOM has planned many PRRs; they are necessary but must be accomplished with slim resources.

A considerable amount of time is spent reacting, rather than acting, i.e., the amount of work required to supply numerous reports on delinquent contractors and on Technical Data Package (TDP) problems. These problems preclude TACOM from focusing its attention on other projects, such as a closer look at secondary item procurements, which later can present serious producibility and production problems if left unattended.

TACOM wants to be able to look at major subcontractors in order to address producibility and production concerns. However, after formal solicitations are issued, the privity of the prime contractor is a factor inhibiting subcontractor reviews.

TACOM emphasized the need for quality combat/materiel developer relationships. Many times Operational and Organizational information is not included in the solicitation package. An example of a program in which this type of information is important is the Palletized Loading System (PLS). This program grew from a British test bed program, which TRADOC used as a basis for a concept and which later evolved into the PLS. The materiel developer can benefit greatly from this type of information by including the O&O information in the solicitation.

Front end producibility concerns are important to TACOM. A current concern is that funding (estimated at $150K plus travel) is not available to pursue producibility issues on the Advanced Fighting Vehicle (AFV) program.

3.5 U.S. ARMY TRANSPORTATION CENTER AND SCHOOL

General:

Following the visit to TACOM, the U.S. Army Transportation Center and School was visited to obtain firsthand information concerning combat developer involvement with the producibility and production aspects of the market analysis process pertaining to wheeled vehicle acquisition programs.

Organizational Structure:

The U.S. Army Transportation Center and School, organized in 1946, has the mission of military transportation doctrine development and research. It also educates and trains military personnel in all aspects of transportation, maintenance and deployment. The TRADOC System Management office and the Directorate of Combat Development are part of the Transportation Center portion of the command.

Transportation Center TRADOC Systems Manager:

One TRADOC Systems Manager is responsible for all Transportation Center wheeled vehicle programs. In an informal meeting with the TSM, selected members of his staff and one representative from the Center and School, it became apparent almost immediately that combat/materiel developer working relationships are quite good.

The Transportation Center TSM office is aware of all significant program concerns and issues including producibility and production. They are, as expected, less attuned than the materiel developer to the engineering aspects of producibility and production, but they express confidence in the capability of the materiel developer's (TACOM) R&D Center to address these issues during technology base activities.

Family of Military Tactical Vehicles:

Figure 3-14 shows an example of a proposed design for the Family of Military Tactical Vehicles (FMTV) configurations. This program is currently estimated as an 80,000-vehicle requirement to be produced over a 15-year period at an approximate cost of 9 billion dollars.

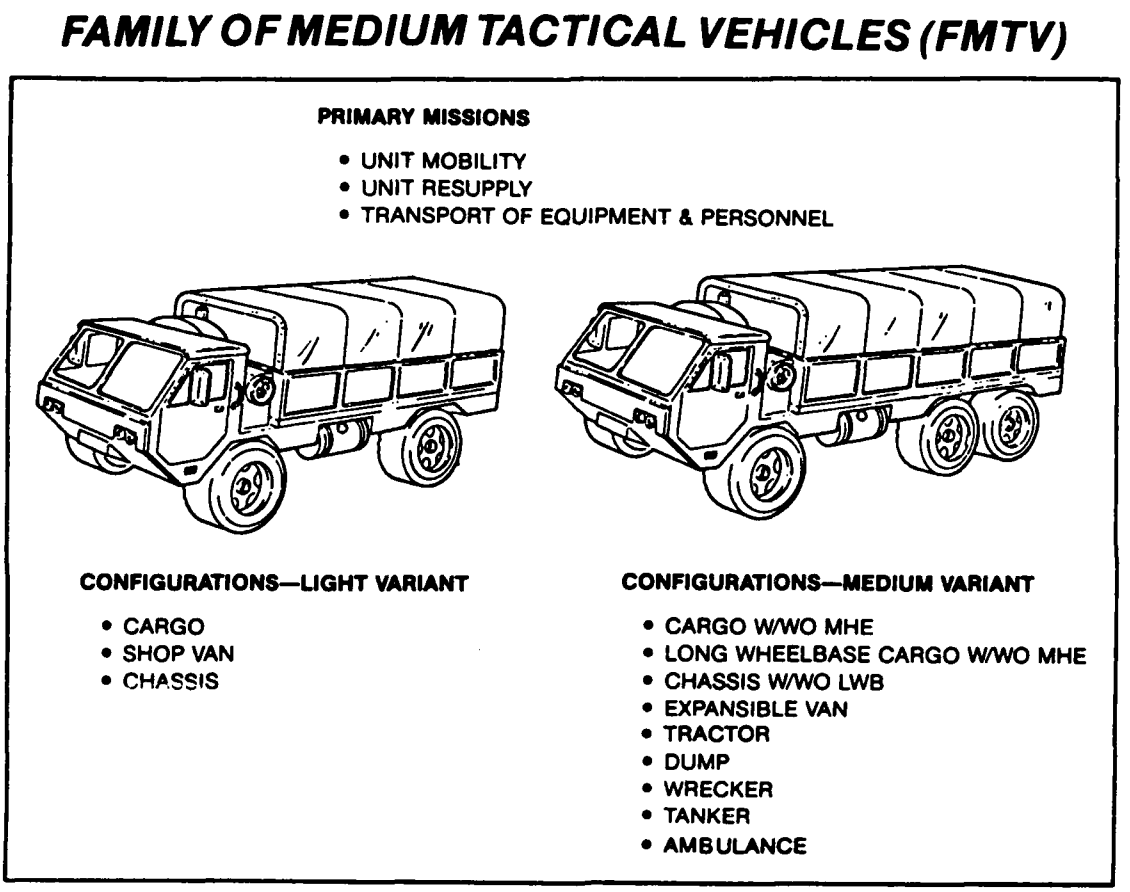

Figure 3-14

The FMTV program did not start as a Transportation Center initiative. It started as a top-down-driven concept by the Department of the Army (DA) Deputy Chief of Staff for Operations (DCSOPS) for a replacement five-ton tactical truck with a one-to-one payload-to-weight ratio. Possible NDI solutions to the requirement and an accelerated acquisition cycle (ASAP) were the preferred methods for acquisition. The Transportation Center did not perform market surveillance activities to identify potential producers, but did establish the coordination link with TACOM. TACOM was informed of this requirement at the same time the Transportation Center received the DA requirement. TACOM proceeded with market surveillance activities, while the

Transportation Center analyzed total Armed Forces needs for both two-and-one-half-ton and five-ton trucks.

Currently, contracts have been awarded to three producers to build 15 trucks (eight 5 ton and seven 2-1/2 ton) and 7 trailers (three 5 ton and two 2-1/2 ton), using existing or modified off-the-shelf commercial hardware and common parts wherever possible for competitive test and evaluation. Maximum use of standard configurations is also an important goal. Transportation Center and TACOM program offices anticipate some producibility and production problems with this program in the areas of militarization and ruggedization. Working together, they plan to closely monitor these areas of concern.

Palletized Load System:

The Palletized Load System (PLS) shown at Figure 3-15, The Palletized Load System, is another example of a competitive prototype evaluation program to select a producer. Currently, contracts have been awarded to three producers for nine trucks, six trailers, and 30 flatracks for test and evaluation. The winning producer is expected to receive a five-year, multi-year contract for 3,800 trucks, 1,600 trailers, and 16,000 flatracks. Potential producibility and production issues can be anticipated with this program but, as with the FMTV program, both the Transportation Center and TACOM are closely monitoring these potential issues.

THE PALLETIZED LOAD SYSTEM

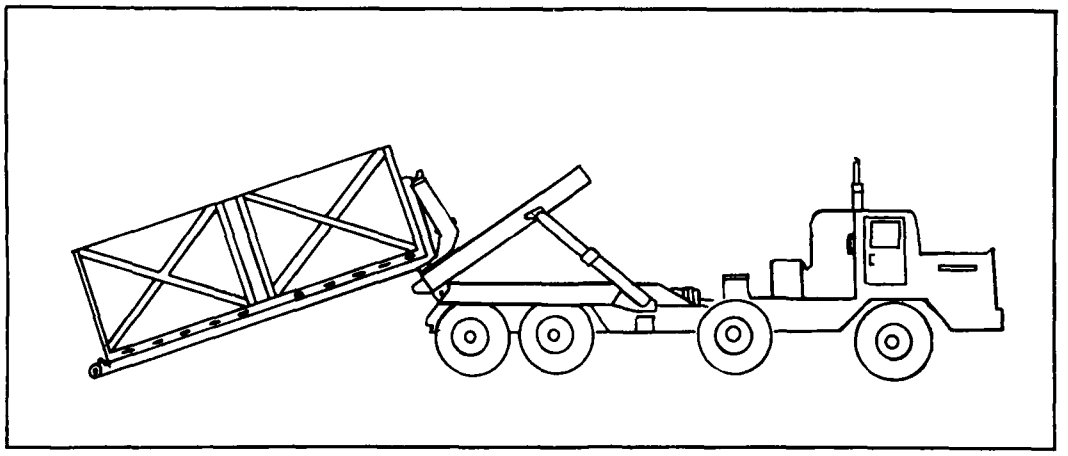

Figure 3-15

3.6 BELVOIR RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

General:

The Belvoir Research, Development and Engineering (RD&E) Center, Fort Belvoir, VA, is one of two U.S. Army Troop Support Command (TROSCOM) centers. TROSCOM, located in St. Louis, MO, is the AMC MSC for Army general purpose items.

BRDEC was selected because of its varied projects, its recent procurement experience (it was taken over by TROSCOM as a result of reorganization) and, until recently, its collocation with the U.S. Army Engineer Center and School (since relocated to Fort Leonard Wood, MO). As a result, BRDEC personnel have prior experience in R&D, engineering, test and evaluation, and procurement, plus experience with the Engineer Center.

BRDEC is engaged in many different areas of development and acquisition program management for products assigned to the Corps of Engineers and the Quartermaster Corps, and it supports physical security detection and intrusion systems assigned to the Military Police Corps. BRDEC programs are heavily oriented towards NDI acquisitions. Most of these programs are for comparatively small quantities of end items having small total dollar values, i.e., unique applications such as mine detection and water purification systems.

Organizational Structure:

Producibility and production matters are part of the mission of the Production Engineering and Standardization Division of the Directorate of Product Assurance and Engineering. This division disseminates Army-wide, AMC and TROSCOM guidance, develops local command implementing instructions, and provides direct assistance to the Directorates for Combat Engineering (physical security, counter-surveillance, deception and bridging); Materials, Fuels and Lubricants; Countermine Systems; and Logistics Equipment (fuel and water supply, marine and mechanical equipment, power-generation and environmental control

systems). The day-to-day functional producibility and production work is performed, supervised or managed by the functional area project leaders.

The geographical separation from its headquarters and procurement offices, and from the combat developers with whom it works, plus the fact that most of the systems developed at BRDEC are low-density, low-dollar-value programs which are frequently less visible, pose many challenges for this center. Producibility and production issues are no exception. To learn more about these issues, the Producibility Engineering Branch of the Production Engineering and Standardization Division arranged for two meetings on 11 April 1989, one in the Directorate for Logistics Equipment Program Management Division, and the other in the Countermine Systems Directorate Development and Engineering Division. These two meetings were intended to provide the views of BRDEC project personnel concerning producibility and production at the front end of the acquisition cycle.

Market Surveillance Issues:

The first meeting, in the Logistics Equipment Directorate, surfaced several concerns, the first of which was that no automated database for market surveillance data exists although a considerable amount of information is available either on-site or through access to other databases such as DTIC and Haystack. The only centralized sources of current data either are in-house or through access to the databases of the BRDEC technical library. Much of the in-house data is in catalog or microfiche format. Approximately 60 to 70 percent of market surveillance data is located in the individual laboratory project team areas. Most of this data resides in files of trade journals and product brochures, technical reports, contractor correspondence, specification sheets and project notes. The value of some of this data is questionable due to its age. Although some of the data obviously is old (five or more years) and is scattered throughout the various laboratory areas, it may be the best choice for specialized project needs. Additionally, much of this specialized data is of little use to unrelated projects. Countermine data, for example, is of no use in the Energy and Water Resources area.

Producer Identification:

The producibility and production aspects of this market surveillance data were understood and appreciated. The current business climate is dynamic, and any producer information is subject to change. Such information must be checked against current producer indexes to determine if the information is still valid. For some items, there are only a few potential producers, and many of them are small businesses. Their capabilities may be in a unique manufacturing process, a patented design, the particular expertise of an individual design engineer, or the specialized skills of a few craftsmen. The market surveillance files help preserve some of BRDEC's corporate memory concerning these processes and people.

NDI Concerns:

There is no lack of emphasis on the requirement to identify producers having requisite producibility and production capabilities. There is, as well, no lack of emphasis on the requirement to acquire NDI materiel as the preferred acquisition alternative. There is, however, much concern regarding the way these NDI projects are developed, managed and acquired. The following paragraphs address the significant concerns discussed by people working on individual projects. Generally, the paragraphs present a consensus of opinion.

Early Planning:

O&O plans are not always seen by project team personnel. Therefore, they have little opportunity to comment on them or, more importantly, to assist and present practical producibility approaches to meeting user needs. Sometimes, combat developers present O&O plans only after they are finalized, which may imply a lack of coordination with, concern about or interest in the materiel developer's engineering staff. Without early information regarding O&O planning activities, the task of addressing producibility and production concerns before they become problems is compounded.

The use of NDI materiel virtually dominates the thinking of the combat developer; it is reflected in O&O plans which, in the opinion of some project team personnel, take on the appearance of a commercial specification. As stated earlier, the need to use NDI as the

preferred acquisition alternative is well understood, but to mandate NDI before the materiel developer can analyze requirements may not be the best course of action.

Project teams are able to discuss producibility and production issues as part of the Materiel Acquisition Review Board (MARB) process, but the teams expressed apprehension regarding any real influence these discussions may have.

Offshore Producers:

A comment was made concerning the short time frames allowed in which to consider offshore producers. The opinion was that the allotted time is entirely too short, which admittedly leaves foreign producers almost out of the picture. BRDEC prefers to use U.S. producers, but it also recognizes the potential of offshore technology and production capabilities.

Product Descriptions and Specifications:

The mandated use of Commercial Item Descriptions (CIDs) in lieu of Military Specifications (MILSPECs) drew sharp criticism. One concern was the use of off-the-shelf pumps in potentially harsh environments. These items represent one of the approximately 400 Federal Supply Classifications (FSCs) selected for commercial procurement. In this case, the BRDEC engineers were concerned that the commercially available items would not survive as major components of larger end items in the tactical and climatic environments in which they might be employed. A specific concern was the estimated mean time between failure, which BRDEC engineers consider to be totally inadequate for mission performance. There was no reluctance concerning the use of commercial items when vendors could demonstrate the production of these items with acceptable quality. The engineers also expressed the view that their requests for waivers were either ignored or denied.

Another BRDEC concern was that the total calculation of life cycle costs may not receive adequate consideration. Three inherent costs were mentioned as possibly being out of balance: 1) costs for additional units to compensate for poor unit performance; 2) costs of logistics support to pack, store and transport; and 3) additional labor costs (forward military

element) to replace components of defective mission-essential systems.

Technical Data Packages:

Technical Data Packages (TDPs) are a continuing concern. Totally generic TDPs are virtually impossible to generate except for the simplest of items. BRDEC employs contractor support to perform most TDP scrub work; BRDEC generally is satisfied with the quality of this work. Two problems make TDP management difficult: 1) competitive procurements, and 2) contractor insistence on TDP changes. Both problems are recognized as probably being beyond the control of project teams, but the teams ask for recognition and understanding of their concerns. It was obvious to team members that a competitive procurement policy had advantages, but they feel that recognition of the potential disadvantages is lacking. They felt that the weighing of a low bid versus technical competence is severely weighted in favor of the low bid; this is detrimental to a fair and reasonable consideration of producibility and production issues.

Preaward Surveys:

Preaward surveys were mentioned as being good opportunities in which to consider and address producibility and production concerns. Opinions were that both BRDEC and Defense Contract Administration Service (DCAS) efforts to provide quality, unbiased assessments are not as carefully considered as they should be. Also, DCAS offices are thinly spread in many instances, which may preclude full coverage of producibility and production issues during these surveys. However, BRDEC/TACOM preaward survey activities received favorable comments. A BRDEC/TACOM team organization seems to work well.

Market Investigation Issues:

The second of the two meetings at BRDEC was with project team representatives of the Development and Engineering Division of the Countermine Systems Directorate. This meeting started with a discussion of market investigation data sources. In addition to the technical library and project file sources discussed during the first meeting, other sources were the Thomas Register and memberships in professional engineering associations. Moreover, foreign

technology was analyzed to identify potential NDI products in some areas.

Conventional processes of searching for data and contacting U.S. representatives abroad were viewed as both slow and cumbersome. The most expeditious way to obtain information has been to contact foreign representatives assigned to embassies in Washington. Reactions to these contacts have been varied; however, the British were described as aggressive marketeers. The French were described as moderately interested; the Israelis as less interested. BRDEC's opinion was that these differences may be caused by personalities; they depend on the marketing interests and aggressiveness of the foreign representatives. For instance, the United Kingdom representative at BRDEC quickly channeled requests for information to the industry representative at the U.K. embassy for action. For commercial items such as construction equipment, the British were fast to act on these requests. For items having military applications, such as the mine probe requirement, they reacted with slower but reasonable speed.

As a related issue, a market investigation conducted by the PMO, Mobile Electric Power (MEP) also was discussed. PMO, MEP earlier had attempted to establish a data base, primarily for foreign power equipment producers, but there were only a few responses to his requests for information. One reason for this attempt was the standardization agreement requirement to provide a 50/60Hz capability for US/European AC power systems.

Availability of Database and Project Information:

Access by the project team personnel in the laboratories to outside data bases is not a problem. It was emphasized that the industrial engineers must display initiative in order to get needed information. Also, since each team is linked to electronic mail (E-mail), which is checked daily, E-mail certainly can be used to expedite industrial engineering actions.

Comments regarding the availability of O&O plans were the reverse of comments made in the first meeting. O&O plans normally are made available for project team analysis early in the acquisition process.

During the discussion of the BRDEC/TRADOC relationship, concern was expressed that TRADOC tends to force commercial products on the materiel developer, in the belief that the NDI approach always will work. Although the project team personnel do not take issue with the requirement to consider NDI as the preferred acquisition approach, they believe that there are instances when NDI products will not meet requirements. Their concerns were that producers frequently prove to be less flexible than anticipated, and therefore could have difficulty achieving higher production rates and meeting military quality requirements.

Management Concerns:

One management problem discussed at the meeting was that many engineers find it increasingly difficult to concentrate on engineering tasks. One of the engineers, with many years of Government service, summed up the problem by saying that 20 years ago the ratio of managers to engineers was much less than what it is today. The point was that the engineers spend too much time responding to the demands of management and not nearly enough time performing engineering work. In the engineers' view, this is a systemic problem which inhibits their ability to devote appropriate time to technical concerns, and they admitted that cursory examinations of producibility and production issues could be the prelude to problems later in the acquisition cycle.

The BRDEC opinion was that there are many problems related to producibility and production which stem from the current procurement system. For NDI acquisitions, this could be dangerous. The working engineers perceive that there is no formal development activity for NDI products, and that prototyping efforts are informal at best because only the concept is demonstrated. They apparently are not asking for a NDI development program; this would defeat the goal of capitalizing on our already-developed systems. But they do seem to be searching for a more disciplined approach to the NDI process.

3.7 LOGISTICS MANAGEMENT INSTITUTE

General:

The Logistics Management Institute (LMI) is a private, nonprofit research and development firm located in Alexandria, VA. LMI was tasked by the AMC International Cooperative Programs (AMCICP) office to develop Phase I of an improved Foreign Market Analysis System (FMAS), part of the Army Streamlined Acquisition Program.

LMI was visited on 28 March 1989 for two reasons: 1) to discuss its efforts to improve access to foreign market data bases for market surveillance purposes, and 2) to determine if these databases contained information related to foreign market producibility and production.

Foreign Market Analysis Deficiencies:

One of the alternatives which must be considered before initiating a new development program is to buy off-the-shelf items or to modify existing commercial, other Service, or foreign equipment to meet a system requirement.

After conducting more than 100 observations during five months of interviewing FMAS participants, reviewing documents and visiting the Office of the Secretary of Defense (OSD), HQDA, AMC, TRADOC, three AMC MSCs, and various Government and commercial establishments in Belgium, France, the Federal Republic of Germany, Luxembourg, and the United Kingdom, LMI concluded that:

- Foreign market analysis does not appear to be pursued as vigorously by MSCs or PMOs as its potential benefits warrant.

- The FMAS is not managed as a system because it is not viewed as a system.

- Analysis of foreign defense materiel and technology markets is viewed as being part of the NDI process.

- The only systematic management of FMAS is in connection with the Foreign Weapons Evaluation (FWE) and NATO Comparative List (NCT) programs.

- No market surveillance (MS) system exists as such; there are only a number of highly individualized MS files which are maintained in a variety of ways.

The LMI conclusions closely parallel the observations made during the visits to AMC MSCs, TRADOC, and TRADOC Schools and Centers to gather data for this report. Generally, foreign market data is fragmented, and there was not much discussion of foreign technology. One possible reason for the apparent lack of emphasis on foreign technology may be the problems associated with foreign data acquisition. However, LMI observed that foreign data is available, and it may not be much more difficult to obtain than much of the domestic data. Although much of this data is fragmented, it can be located with a little initiative. Another LMI observation, which appears more significant in regard to the acquisition and analysis of off-shore surveillance data, is that domestic laboratories, centers and project management offices appear to have vested interests in their own in-house R&D projects; therefore they tend to view foreign opportunities as a threat to those interests.

There have been some successes with foreign technology programs, one example of which is the Mobile Subscriber Equipment (MSE) system (discussed in paragraph 3.3). The LMI view is that most foreign technology success stories are the result of work done by offices such as AMCICP; the U.S. Army Research, Development and Standardization Groups located in Australia, Canada, France, West Germany, and the United Kingdom; and other field representatives. These offices actively push foreign opportunities into the Army's R&D acquisition channels, rather than waiting to identify these opportunities only in response to user needs.

Currently, LMI identifies the major weaknesses of the foreign market analysis system as:

- Little use is made of telecommunications services.

- No use is made of automated data services to provide technological, industrial and commodity information.

- There is inadequate dissemination of U.S. Army requirements.

- Market surveillance policy guidance and procedures are not provided.

- There is a lack of a common means for communicating market information within the R&D community.

Access To Requirements Data:

Discussions with LMI concerning the specific issues of producibility and production in the early stages of an R&D acquisition program revealed that one major deficiency is the market surveillance system's inadequate access to U.S. Army requirements, particularly when those requirements are in the early, formative stages of development. Also, it did not appear that known data bases contain much useful information with which to analyze producibility or production capabilities. The only available example of military acquisition program documentation which addressed the subject of producibility or production was an Executive Summary for an International Armaments Cooperative Opportunities Plan (IACOP). This summary concerned the Light Helicopter Family (LHX) Program. Four parts of the summary are repeated here. They discuss in detail the program's acquisition strategy, but only briefly address producibility or production:

- The Army's acquisition strategy is to limit competition of the Light Helicopter Family (LHX) air vehicle to U.S. and Canadian firms. The Army and, in particular, the LHX project manager (PM), are encouraging U.S. prime contractors to solicit foreign participation in the program to gain economic and technological benefits commensurate with approved technology transfers. This free-market approach is clearly the most effective way to enhance standardization and interoperability and remain within the program cost and time goals. It also allows for managing the international program without an additional resource burden to the Government. The LHX design will also incorporate STANAG 4183, NATO Metrication Policy, and all other applicable ratified NATO Standardization Agreements (STANAGS) to maximize standardization and interoperability (S&I) with our Allies. This policy will enhance and strengthen U.S. defense relationships and facilitate host nation support agreements as well as ensure multiple sources for spare parts.

- In October, 1983, representatives from the Department of the Army briefed the NATO Army Armament Group (NAAG) AC/225 Panel X on the LHX. At three subsequent meetings, U.S. representatives briefed on the LHX program and Rationalization, Standardization, and Interoperability (RSI) intentions. The purpose of these briefings was to convey to our Allies the idea that the U.S. Government has recognized the need to improve NATO's S&I, and that the LHX program goals support this effort. The potential for cooperative development was possible but, because the program was in the early conceptual phase, no determination had been made about the degree of foreign involvement. The briefings did stress that the United States encouraged cooperative production of components and subassemblies on an industry-to-industry basis. These meetings provided recommendations for further discussion of the LHX and approval of the program S&I objectives.

- One of the seven recommended RSI courses of action is: As the LHX program matures, the U.S. Government and the system contractor will pursue coproduction/dual production of components and FMS of the LHX to strengthen defense alliances and to pursue host nation support for theater repair of components at echelons above corps (depot).

- Full Scale Development (FSD) will assess producibility, manufacturing technology research (MTR), manufacturing technology development (MTD) and manufacturing methods and technology (MM&T). Risk segments of the production line and/or capability will be assessed by a pilot production line at the component level. Manufacturing capability and design producibility will be key factors in the selection of production contractors. Current planning is for total aircraft requirements ranging from 4,500 to 5,691 units and a 15-year buyout to replace the older generation light helicopter fleet. Competition at both the prime and subcontractor level is required to ensure an industrial base capable of supporting manufacture and control program costs within established goals.

The LHX is only one of many Army programs, but it serves as an example of how foreign cooperation is approached in terms of producibility and production issues. There is no mention of producibility or production until the Full-Scale Development phase of the program, except as part of a program strategy which limits production to U.S. and Canadian firms.

Foreign Market Analysis System Development:

LMI provided an overview of how it is approaching the Phase I task to develop an improved Foreign Market Analysis System (FMAS). Part of the effort is to improve the ease of access to telecommunications networks in order to acquire foreign market analysis data. Figure 3-16 shows the participating U.S. offices. The initial FMAS concept was to develop new, user-friendly software, and to establish a gateway to the existing electronic "E-mail" network. The initial FMAS users were to be AMC, TRADOC, and three AMC MSCs: CECOM, MICOM and TACOM. LMI anticipates follow-on tasking to expand network access and to include all of the offices shown in Figure 3-16.

In response to a question regarding the types of data or information in the various foreign data bases, the LMI response was that they generally include:

- Financial type data such as overall wealth, profit position, stock value (if public), and other data to permit analysis of financial strengths.

- Exchange listing, if a stock is publicly traded.

- Key company and corporate officers.

- Primary locations of the headquarters, subsidiaries and manufacturing facilities.

- Products regularly produced.

- Other defense products.

No mention was made of any data which would permit more than a cursory view of producibility and production issues for market surveillance purposes. As this network grows and matures, however, market investigation information could include the data and information needed to resolve producibility and production concerns.

FOREIGN MARKET ANALYSIS PARTICIPANTS

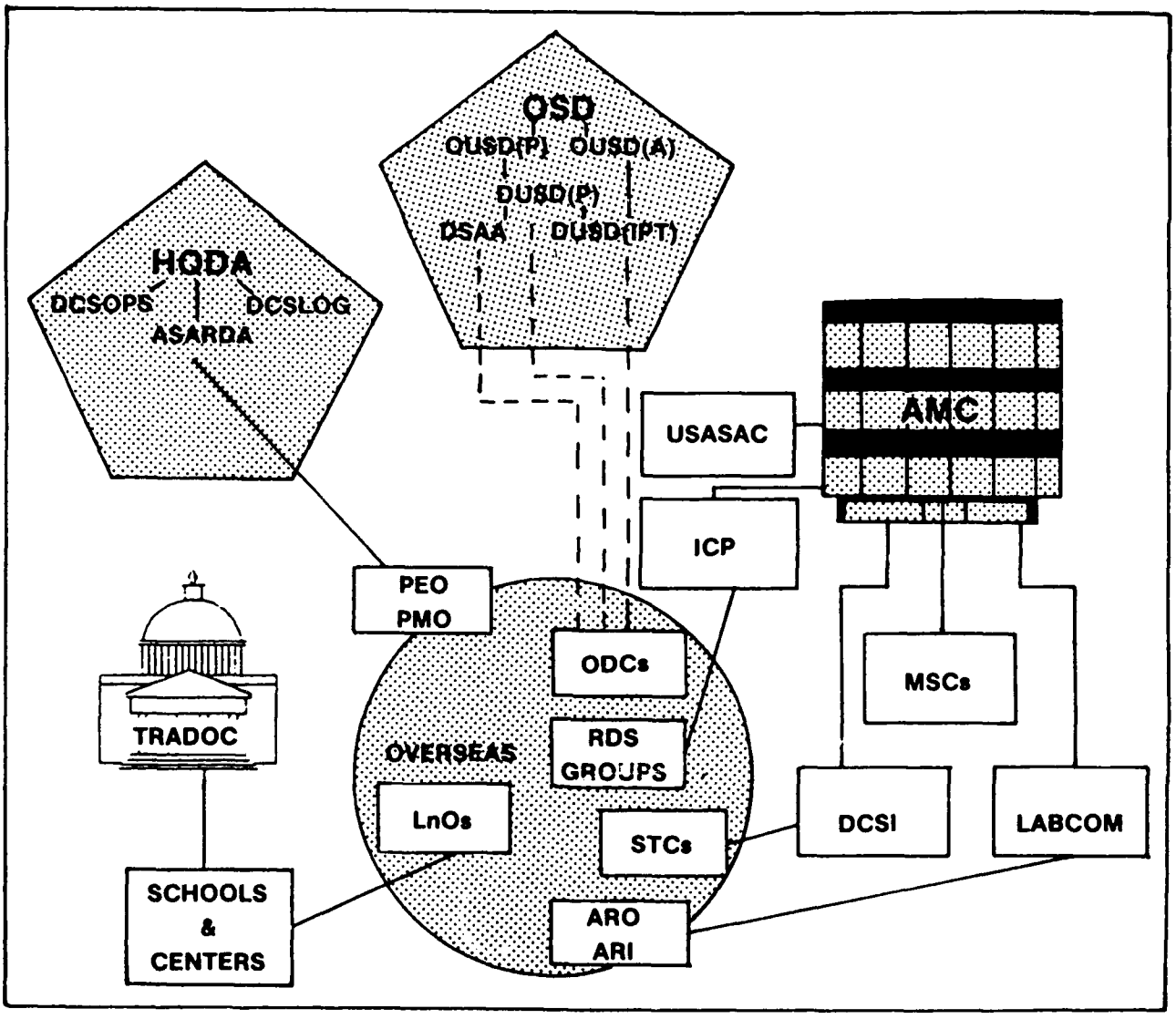

Figure 3-16

SECTION 4.0
CONCLUSIONS

4.1 PRODUCIBILITY AND PRODUCTION CONSIDERATIONS

In general, combat developers do not address producibility and production issues early in the acquisition cycle. There is an assumption that these issues are premature during concept definition and are really the materiel developer's responsibility. Materiel developers are well aware of the potential impact of these issues on program cost, schedule and system performance requirements; nevertheless, they tend to defer producibility and production issues until system requirements are well defined. It does appear that TRADOC (the combat developer's representative) has an appreciation of the need for producible designs and would be receptive to earlier involvement by materiel developers in concept definition.

4.2 MARKET ANALYSIS PROCESS

Market surveillance data maintained by the materiel developers is generally not readily available to combat developers. Ready access to MS data would enhance the combat developer's ability to develop concepts which address producibility concerns. For the most part, MS data is manually maintained by technical experts in the respective RD&E commodity centers.

The automation of market surveillance data has the obvious advantage of the data being easily accessible if remote access capabilities are included in the overall automation effort. This however, may not be the best alternative for all commodities. Since some items are rarely required, they may simply clutter a database with potentially obsolete information. Each commodity area should be examined on a case-by-case basis to assess the merits of automation. Information directly relating to producibility and production issues also may be inappropriate or difficult to obtain for inclusion in the database.

There is general agreement that a market investigation -- in particular, questionnaire preparation -- is an excellent and, perhaps, the best method of identifying potential producibility and production issues. Site visits also are viewed as critical activities in order to obtain first-hand information concerning actual, planned and proposed production capabilities.

4.3 AMC/TRADOC INTERFACE

Adequate policy and procedural guidance has been published emphasizing the importance of close cooperation between combat and materiel developers; however, in many cases the lack of an early dialogue between the TRADOC proponent Centers and the appropriate AMC MSCs or RD&E Centers causes potential issues to be ignored. These issues could impact program cost, schedule and performance requirements later in the acquisition cycle. Significant interface issues are:

- Different perceptions of how producibility and production issues should be treated early in the acquisition cycle.

- The geographical separation of combat and materiel developer communities, i.e., the lack of face-to-face contact to resolve concerns early.

- The existence of protectionism and parochialism which can foster adversarial relationships between combat and materiel developer communities.

- Reluctance to vigorously pursue offshore technology and production capabilities.

4.4 ACQUISITION STREAMLINING

Streamlining the traditional 10-to-15 year acquisition cycle into a compressed 4-to-6 year cycle has the obvious advantage of fielding new and/or improved systems that incorporate state-of-the-art technology in a much faster time frame. Combat developers and materiel developers realize that compression of program activity does not permit the elimination of basic program requirements; "tailoring" of requirements is encouraged in order to eliminate unnecessary or previously accomplished technical activities. A streamlined program requires

the performance of many activities concurrently in order to maintain cost and schedule goals. The pace of a streamlined program tends to move producibility and production issues to the side unless these issues are aggressively pursued by producibility and production engineering personnel having direct or influential program involvement.

4.5 NONDEVELOPMENTAL ITEMS

Nondevelopmental items frequently are viewed as known quantities -- already developed and producible. NDI materiel is regarded as a key ingredient for a successful streamlined acquisition. Potential traps are:

- Items may or may not be in production.

- Demonstrated items may not be prototypes - not production models.

- Military needs may force changes to a commercial item; these changes may introduce producibility and production problems.

- Combat developers are oriented to operational and logistics considerations, and not to producibility and production issues.

- Materiel developers tend to delay the consideration of producibility and production issues until operational requirements are firm and programs are funded.

- Front end research and development funds for NDI programs are limited, and often thought of as being reserved for product test and evaluation only.

- Materiel developers tend to discount known producers' capabilities as irrelevant until after competitive contracts are awarded.

- Selection of low bidders is made without adequate consideration of their technical competence.

4.6 NONDEVELOPMENTAL ITEM DATABASES

AMC and TRADOC databases on NDI producers are in manual (file) form, with the exception of a recently computerized database at CECOM. The CECOM database is not remotely accessible at this time. In contrast, other countries' databases and most commercial databases are automated and accessible via standard telephone network/modem systems. Problems associated with these databases are:

- Producer and production information is fragmented.

- Product data maintained by TRADOC Centers and by AMC MSCs and RD&E Centers are not easily accessed by other activities.

- Data that are not readily available for a review tend to be ignored.

- An atmosphere of protectionism tends to reduce reliance on offshore technology and production capability.

- The existing means of obtaining offshore data are viewed as cumbersome and time consuming.

4.7 OPERATIONAL AND ORGANIZATIONAL PLANNING

O&O planning activities, which are initiated by the combat developer, frequently fail to consider potential producibility and production problems. Preliminary planning involves requirements which are fluid (not precisely defined) and, in most cases, issues such as producibility and production are deferred. Materiel developers also tend to defer any investigations to identify producer capabilities until after O&O requirements are well defined and funded.

4.8 CONCEPT FORMULATION PACKAGES

The CFP process does not require the consideration of producibility until the Best Technical Approach is prepared, which may be too late to ensure that producibility and production issues are properly considered.

4.9 TRAINING

Generally, combat developers lack an appreciation for the potential traps a program may encounter if producibility and production issues are not surfaced early in the acquisition cycle. Materiel developers often fail to realize that their advice and guidance in these areas are vital in order to get programs off to a good start. Early and improved communications, supported by appropriate training, are needed to ensure that producibility and production issues are discussed while they are still concerns and are not yet problems. Insertion of short blocks of instruction on upfront producibility planning into already existing courses on program/project management, acquisition streamlining, R&D management, etc. appears to be a worthwhile endeavor.

SECTION 5.0
RECOMMENDATIONS

5.1 AMC/TRADOC INTERFACE

The AMC/TRADOC interface needs to be strengthened in the producibility and production areas. Recommend that HQ AMC's Production Directorate initiate a program to encourage materiel developers to become more involved with the combat developers in concept definition in order to address the concerns in Section 4.0, CONCLUSIONS.

5.2 MARKET SURVEILLANCE DATA

Market surveillance data needs to be more accessible to combat developers. Recommend that HQ AMC's Production Directorate initiate a program to assess each commodity database with the ultimate goal of selective automation and remote access capability where appropriate.

5.3 TRAINING

Both combat and materiel developer training activities need to be assessed for the logical application of producibility considerations. Recommend HQ AMC's Production Directorate undertake a task towards this end.

APPENDIX A

ACRONYMS

AFV	Advanced Fighting Vehicle
AMC	Army Materiel Command
AMCICP	Army Materiel Command Office for International Cooperative Programs
ANDVT	Advanced Narrow Band Digital Voice Terminal
AR	Army Regulation
ARI	Army Research Institute
ARO	Army Research Office
AS	Acquisition Strategy
ASAP	Army Streamlined Acquisition Program
ASARDA	Assistant Secretary of the Army for Research, Development and Acquisition
BECSS	Battlefield Electronic Communications-Electronics Operating Instructions
BRDEC	Belvoir Research, Development and Engineering Center
BTA	Best Technical Approach
CBD	Commerce Business Daily
CBTDEV	Combat Developer
CECOM	Communications-Electronics Command
CFP	Concept Formulation Process/Package
CG	Commanding General
CNR	Combat Net Radio
COEA	Cost and Operational Effectiveness Analysis
DA	Department of the Army

DC	Direct Current
DCD	Directorate for Combat Development
DCG	Deputy Commanding General
DCSI	Deputy Chief of Staff for Intelligence
DCSLOG	Deputy Chief of Staff for Logistics
DCSOPS	Deputy Chief of Staff for Operations
DSAA	Defense Security Assistance Agency
DSMC	Defense Systems Management College
DTIC	Defense Technical Information Center
DUSD(IPP)	Deputy Under Secretary of Defense for International Programs and Policy
DUSD(P)	Deputy Under Secretary of Defense for Policy
FM	Frequency Modulation
FMAS	Foreign Market Analysis System
FMTV	Family of Military Tactical Vehicles
FR	France
GTE	General Telephone and Electronics (Corporation)
HQ	Headquarters
HQDA	Headquarters, Department of the Army
IACOP	International Armaments Cooperative Opportunities Plan
ICP	International Cooperative Program
IHFR	Improved High Frequency Radio
IP	Industrial Preparedness
LABCOM	Laboratory Command
LNO	Liaison Officer

LMI	Logistics Management Institute
LOS	Line of Sight
LRRDAP	Long Range Research, Development and Acquisition Plan
MAMP	Mission Area Materiel Plan
MANPRINT	Manpower and Personnel Integration
MARB	Materiel Acquisition Review Board
MATDEV	Materiel Developer
MI	Market Investigation
MINTERM	Miniature Terminal
MM&T	Manufacturing Methods and Technology
MOI	Memorandum of Instruction
MOS	Military Occupational Specialty
MS	Market Surveillance
MSC	Major Subordinate Command
MSE	Mobile Subscriber Equipment
MSRT	Mobile Subscriber Radio Terminal
NAAG	NATO Army Armament Group
NATO	North Atlantic Treaty Organization
NDI	Nondevelopmental Item
NTIS	National Techr. ormation Service
O&O	Operational and Organizational
OSD	Office of the Secretary of Defense
OUSD(A)	Office of the Under Secretary of Defense for Acquisition
OUSD(P)	Office of the Under Secretary of Defense for Policy

Pam	Pamphlet
PEO	Program Executive Officer
PEP	Producibility Engineering and Planning
PLS	Palletized Load System
PM	Program/Project/Product Manager
PMO	Program/Project Management Office
POC	Point of Contact
PR	Producibility Review
PRR	Production Readiness Review
P&MT	Production and Manufacturing Technology
P3I	Pre-Planned Product Improvement
RCA	Radio Corporation of America
RDE	Research, Development and Evaluation
RDSGrps	Research, Development and Standardization Groups
R&D	Research and Development
RD&E	Research, Development and Evaluation
RD&S	Research, Development and Standardization
RDT&E	Research, Development, Test and Evaluation
RFP	Request for Proposal
RITA	French Automatic Transmission Network (RESEAU Integre de Transmissions Automatique)
RSI	Rationalization, Standardization and Interoperability
SINCGARS	Single Channel Ground/Airborne Radio System
SLR	Squad Level Radio
SSEB	Source Selection Evaluation Board

SSG	Special Study Group
STAJ	Short Term Anti-Jam
STC	Science and Technology Center
STF	Special Task Force
TACOM	Tank-Automotive Command
TDP	Technical Data Package
Thomson-CSF	French Communications Manufacturer-Compagine de Telegraphic Sans Fil (i.e., Thompson CSF)
TOA	Trade-Off Analysis
TOD	Trade-Off Determination
TRADOC	Training and Doctrine Command
TRISO	Technical Requirements Integration Staff Officer
TRI-TAC	Tri-Service Tactical Communications Systems Office
TROSCOM	Troop Support Command
TSM	TRADOC System Manager
UK	United Kingdom
US	United States
USASAC	United States Army Security Assistance Command
VE	Value Engineering
VECP	Value Engineering Change Proposal
W/WO LWB	With/Without Long Wheel Base
W/WO MHE	With/Without Materials Handling Equipment

APPENDIX B

MANUFACTURER'S QUESTIONNAIRE
for
DESERT MOBILITY VEHICLE SYSTEM (DMVS) TRAILER

GENERAL: The purpose of this questionnaire is to aid in determining the suitability of your company's product to satisfy the United States Army requirements for a Desert Mobility Vehicle System (DMVS) trailer. The DMVS consists of a High Mobility Multi-purpose Wheeled Vehicle (HMMWV), a motorcycle, and a trailer to transport the motorcycle. The motorcycle is approximately 90 in. long and the total required trailer payload weight is approximately 2400 lb. The trailer is also desired to have the same wheel track width (72 in.) as the HMMWV as well as the same wheels and tires as the HMMWV (Goodyear Wrangler R/T II, 36 x 12.5 x 16.5 LT, Military 02). Approximately 50 to 100 trailers total are required to fulfill the role of the DMVS.

INSTRUCTIONS: Please answer all questions applicable to your product for which you have data. Any supplemental information concerning the performance, human factors, engineering, safety, quality assurance program, reliability/maintainability of a candidate trailer or other literature concerning your company's warranty program and production longevity would be usefull in this survey. Also included for your review is an Organizational and Operational Plan and draft Required Operational Capabilities document which specify the performance of the system.

NOTE: Your participation in this survey is voluntary and the United States Army will not pay for any information provided.

A. GENERAL:

1. MANUFACTURER

   a. Name_____
   b. Mailing Address_____
   _____
   _____
   c. Plant Location_____
   _____
   _____

2. MANUFACTURER'S REPRESENTATIVE
   a. Name_____
   b. Title_____
   c. Telephone Number_____

3. DMVS TRAILER DESCRIPTION

   a. Name_____
   b. Make_____
   c. Model_____
   d. Brief Description_____
   _____
   _____
   _____
   e. Please include a descriptive brochure if available.

B. PHYSICAL CHARACTERISTICS

1. WEIGHT

a. Total curb weight_____
b. Payload capacity_____
c. Gross vehicle weight_____
d. Ground pressure at:
   i. Curb weight_____
   ii. GVW, payload centered over wheels_____
e. Center of gravity at curb weight (longitudinal, transverse, vertical)_____
f. Tongue load at curb weight_____

2. DIMENSIONS

a. Overall length (including drawbar)_____
b. Overall width _____
c. Overall height_____
d. Ground clearance_____
e. Cargo area length_____
f. Cargo area width_____
g. Submit a three-view (top, side & end view) dimensioned drawing of the trailer, if available. Show location of center of gravity (Longitudinal, vertical and transverse).
h. Tongue height(s) with level bed_____
i. Wheelbase (wheel centerline to drawbar hitch)_____

3. TRAILER PERFORMANCE

a. What is the sustained speed that the trailer can be towed at GVW:
   i) Cross-country_____
   ii) Unimproved roads /trails_____
   iii) Improved roads_____
b. Maximum side slope which the trailer can be towed at curb weight (including starting and stopping)_____
c. Maximum grade which brakes will hold at trailer GVW, detached from vehicle:
   Trailer facing down grade_____
   Trailer facing up grade_____
d. Maximum fording capability (depth with no hub contamination) without prior preparation (at curb weight)_____
e. What landing jacks and leveling/stabilizing capabilities are provided? (Incude max grades/side slopes at which trailer can be leveled at GVW)_____
f. Describe any stabilization system to level the trailer on slopes and grades?_____
   _____
   _____

4. CARGO AREA

a. Is the cargo area enclosed? _____
b. If enclosed, is the top removeable?_____
c. Does the trailer have sides?_____
d. If the trailer has sides, are they removeable?_____
e. Describe cargo tiedowns and locations, if any_____
   _____
   _____

f. Does cargo area have a removeable guide(s) suitable for securing a motorcycle (approx. 350cc SAE class A type) for transport?_____

g. Does cargo area employ a ramp suitable for loading a motorcycle (approx. 350cc SAE class A type) for transport?

_____

5. SUSPENSION

a. Type/Description:_____
_____
_____

b. Shock description_____
_____
_____

c. Is shock absorber adjustable?_____
If so, describe_____
_____

d. Is the shock absorber maintainable?_____

e. Tire make/type/size_____
_____

f. Wheel track width_____

6. ELECTRICAL

a. Required voltage_____

b. Describe lighting system_____
_____

c. Does the lighting system meet the requirements of FMVSS 108
_____

d. Secure/blackout capabilities?_____
_____

e. Describe the electrical interface between the operational vehicle and the trailer_____
_____

f. Is the electrical system water-proof?_____

g. Describe the number, size and location of reflectors_____
_____

7. BRAKES

a. Describe trailer braking system_____
_____
_____

b. Is the trailer braking system independent of the operational vehicle?_____

c. Can the trailer be braked manually with the trailer disconnected from the vehicle?_____
If so, can they be applied independently?_____

8. SURVIVABILITY

a. Is the trailer Chemical Agent Resistance Coated, i.e. CARC painted?_____

d. Does the vehicle have tires designed to survive puncture from thorns and rocks (minor repair allowed)?_____
If so, describe_____

C. RELIABILITY/AVAILABILITY/MAINTAINABILITY

1. SUSTAINABILITY

a. What is the design life of the trailer?_____
On what usage factors (mission profile, terrain mix, speeds, etc.) is this design based_____

b. Explain the warranty on the trailer_____

c. Do you have any formal field feedback system other than demand data?_____If so, describe_____

2. RELIABILITY

a. A failure is briefly defined as any incident that stops the product from moving or creates a condition such that continued operation could probably cause more significant damage to the product or create a safety hazard for the operator, or cargo. (If your definition of failure is different, please describe.)_____

b. What is the demonstrated reliability, mean (average)-miles between-failure of the following:
1) Electrical_____
2) Brakes_____
3) Suspension_____
4) Springs_____
5) Shocks_____
6) Axles_____
7) Other_____

c. If above values are from test data, describe the test and test profile._____

3. MAINTAINABILITY

a. What is the demonstrated maintainability, mean (average)-time-to-repair = MEAGRE and maintenance time/operation time = MY

	MEAGRE	MY
1) Electrical		
2) Brakes		
3) Suspension		
4) Springs		
5) Shocks		
6) Axles		
7) Other		

b. What is the frequency required of all scheduled maintenance
   1) Daily_____
   2) Quarterly_____
   3) Semi Annually_____
   4) Annually_____

c. How many operators are required to perform these checks?_____

d. Describe the skill level of the mechanic who would perform scheduled maintenance_____

e. What tools are required to perform a complete scheduled maintenance_____

f. Are these tools available in a kit from your company?_____

g. Are these tools normally carried on the vehicle or trailer?_____

h. Describe any unique tools that are required for maintenance?_____

D. TRAILER SAFETY

1. Does the trailer meet applicable Federal Motor Vehicle Standards (FMVSS) and Federal Motor Carrier Safety Regulations (FMCSR)?_____

2. Are safety chains provided to secure the trailer to the prime mover?_____

3. Is the trailer free of sharp edges or projections that could cause harm to personnel?_____

4. Please attach all product safety analysis data to the questionnaire.

E. TRANSPORTABILITY

a. Please describe the modes of transportation that have successfully transported the trailer:

Airplane (types)_____

Helicopter (types)_____

Cargo Truck (types)_____

Marine Vessel (types)_____

Rail _____

b. Explain what type of lifting and tiedown system is used to transport the trailer?_____

_____

_____

c. Has the trailer been both Low Altitude Parachute Extracted and Low Velocity Air Dropped successfully_____

_____

F. LOGISTICS SUPPORT

a. What type of documentation is provided with this trailer?

	YES	NO
(1) Operations manual	____	____
(2) Maintenance manual	____	____
(3) Troubleshooting manual	____	____
(4) Repair/Spare parts breakdown	____	____
(5) Illustrated parts breakdown	____	____
(6) Required tools list	____	____
(7) Training manual	____	____

b. Are stencils or decals pertaining to instructions affixed to the trailer? _____ Please describe. _____

_____

_____

c. Does your company have experience in preparation of logistics support analysis records (LSAR), technical publications, training materials, packaging, and engineering data/reports?_____ If so, explain _____

_____

_____

d. Does your company have a designated ILS manager for the trailer?___

_____ _____

G. PARTS & SUPPLIES

a. Describe your complete distribution network for parts. Include locations in foreign countries._____

_____

_____

b. Do each of your parts distributors stock a complete line of replacement parts?_____
If no, explain_____

_____

_____

c. Provide a repair parts listing and price breakdown for the trailer.

d. Are commercial facilities available to support a complete overhaul for the trailer._____

_____

_____

H. PRODUCTION

1. Is this trailer model currently in production _____
2. How long has this model been in production _____
3. How many units of this model have been produced _____
4. What is the current rate of production _____
5. When is your production run scheduled to end _____
6. How many units do you keep in stock on a regular basis _____
7. How many days after receipt of an order is shipment made if units are in stock _____ not in stock _____
8. What is the maximum production capability per month _____
9. How many units are in use today _____
10. Has this model ever been sold to any government agency _____ (Federal, State, Local or Foreign)? _____ If so, give agency name, address, and quantity _____
11. Who are the principal users of the trailer (please attach a list of names, addresses, and telephone numbers) _____
12. Describe your engineering change procedures. _____

APPENDIX C

PERSONNEL INTERVIEWED

NAME	OFFICE SYMBOL	TELEPHONE NUMBERS
HEADQUARTERS, TRAINING AND DOCTRINE COMMAND		
Ronald M. Cross	ATCD-ET	(804)727-3972 AV: 680-3972
U.S. ARMY COMMUNICATIONS-ELECTRONICS COMMAND		
Colin F. McDonnell, Jr.	AMSEL-ED	(201)532-5193 AV: 992-5193
James Barbarello	AMSEL-ED-S	(201)532-5764 AV: 992-5764
Charles Johnson	AMSEL-ED-SP	(201)532-5891 AV: 992-5891
Harry G. Ivory	AMSEL-ED-P	(201)532-4753 AV: 992-4753
Mark B. Karney	AMSEL-ED-PH	(201)532-2650 AV: 992-2650
Sada Barik	AMSEL-ED-PI	(201)532-4995 AV: 992-4995
Ray Woolley	AMSEL-ED-PS-2	(201)532-3535 AV: 992-3535
Frank King	AMSEL-ED-PS	(201)532-1464 AV: 992-1464
James G. McDonald	AMSEL-RD-TPPO-N	(201)544-2995 AV: 992-2995
Kenneth A. Tangury	Computer Sciences Corp.	(201)544-2995 AV: 992-2995
Michael J. Polizotto	Computer Sciences Corp.	(201)544-2995 AV: 992-2995

U.S. ARMY SIGNAL CENTER AND SCHOOL

LTC Johern H. Ewing	ATZH-CR	(404)791-2057 AV: 780-2057
MSG John P. Fillop	ATZH-CR	(404)791-2057 AV: 780-2057
William E. Kelley	ATZH-ME	(404)791-3805 AV: 780-3805
CPT Michael T. Mokrycki	ATZH-CDL	(404)791-2628 AV: 780-2628
Jon M. Raider	ATZH-CDM	(404)791-7177 AV: 780-7177

U.S. ARMY TANK-AUTOMOTIVE COMMAND

Jamie Florence	AUSTA-TMM	(313)574-6065 AV: 786-6065
CPT Eddie C. Coppock	AMSTA-ICCB	(313)574-7017 AV: 786-7017
Monica Kapso	AMSTA-ICCB	(313)574-7124 AV: 786-7124
Jay L. Willis	AMSTA-ICC	(313)574-7011 AV: 786-7011
Jack Pilon	AMSTA-ICB	(313)574-7121 AV: 786-7121
Michael J. Scharra	PEO, CBT SPT	(313)574-5439 AV: 786-5439
Richard Kaiser	AMSTA-ZDM	(313)574-8910 AV: 786-8910
MAJ Robert Hileman	AMSTA-ZDS	(313)574-7315 AV: 786-7315
Norm Gebhardt	AMSTA-CAB	(313)574-7115 AV: 786-7115
Bill Tarockoff	AMSTA-ICBB	(313)574-6076 AV: 786-6076

U.S. ARMY TRANSPORTATION CENTER AND SCHOOL

COL John G. Larkins	ATZF-TW	(804)878-5552 AV: 927-5552
MAJ Brian Case	ATZF-TW (FMTV)	(804)878-2358 AV: 927-2358
SGM Richard P. Camille	ATZF-TW (HETS)	(804)878-2358 AV: 927-2358
Lynn Lentz	ATZF-TW (PLS)	(804)878-2358 AV: 927-2358
John Wright	ATZF-TW (HMMWC)	(804)878-2358 AV: 927-2358
Richard A. Hartert	ATSP-CD-MS	(804)878-5744 AV: 927-5744

BELVOIR RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

William M. Griffin	STRBE-TSX	(703)664-6906 AV: 354-6906
Frank Innis	STRBE-TSX	(703)664-5127 AV: 354-5127
Harry Hambric	STRBE-HP	(703)664-2095 AV: 354-2095
Elizabeth Radowski	STRBE-FP	(703)664-5830 AV: 354-5830
David Krawchuk	STRBE-FMR	(703)664-1143 AV: 354-1143
John Strandell	STRBE-FSH	(703)664-5744 AV: 354-5744
Paul L. Propst	STRBE-FSQ	(703)664-5746 AV: 354-5746
Larry Turnipseed	STRBE-FSH	(703)664-5972 AV: 354-5972
Greg Wesley	STRBE-FES	(703)664-6031 AV: 354-6031

Mel Gordon	STRBE-FRD	(703)664-5498 AV: 354-5498
Tom Childers	STRBE-FGE	(703)664-5587 AV: 354-5587
Harold Harris	STRBE-FSE	(703)664-4678 AV: 354-4678
Byrd Pritchett	STRBE-FEP	(703)664-5871 AV: 354-5871
Larry Weglarz	STRBE-NDF	(703)664-4165 AV: 354-4165
Stephen H. Bennett	STRBE-NDF	(703)664-4165 AV: 354-4165
John J. Bianchi	STRBE-NDD	(703)664-4498 AV: 354-4498
John Allison	STRBE-NDM	(703)664-5470 AV: 354-5470

LOGISTICS MANAGEMENT INSTITUTE

Carl Groth, PhD	Research Fellow	(703)461-9400 AV: 284-3029
Cynthia Shockley	Research Fellow	(301)320-2000 AV: 287-2127
Bridgette Cao	Research Fellow	(703)461-9400 AV: 284-3029

APPENDIX D

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
AMC	
U.S. Army Materiel Command 5001 Eisenhower Avenue ATTN: AMCDE-AQP Alexandria, VA 22333-0001 POC: Sandy Rittenhouse (9N08)	C: (202)274-8284 AV: 284-8284
U.S. Army Materiel Command Industrial Engineering Activity ATTN: AMXIB-P Rock Island, IL 61299-7260 POC: James W. Carstens James T. DeWoody	C: (309)782-5113 (309)782-6556 AV: 793-5133 793-6556
U.S. Army Materiel Command 5001 Eisenhower Avenue ATTN: AMCICP-FM Alexandria, VA 22333-0001 POC: Jose D. Francisca (5S11)	C: (202)274-9398/9399 AV: 284-9398/9399
U.S. Army Communications-Electronics Command ATTN: AMSEL-ED Ft. Monmouth, NJ 07703-5201 POC: Colin F. MacDonnell, Jr. (3B28 Green Wing)	C: (201)532-5193 AV: 992-5193
U.S. Army Communications-Electronics Command ATTN: AMSEL-ED-S Ft. Monmouth, NJ 07703-5201 POC: James Barbarello	C: (201)532-5764 AV: 992-5764

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
U.S. Army Communications-Electronics Command ATTN: AMSEL-ED-P Ft. Monmouth, NJ 07703-5201 POC: Harry Ivory	C: (201)532-4753 AV: 992-4753
U.S. Army Communications-Electronics Command ATTN: AMSEL-RD-TPPO-N Ft. Monmouth, NJ 07703-5000 POC: James G. McDonald	C: (201)544-2995/4264 AV: 992-2995/4264
U.S. Army Tank-Automotive Command ATTN: AMSTA-IC Warren, MI 48397-5000 POC: Prince Young	C: (313)574-6972/7163 AV: 786-6972/7163
U.S. Army Tank-Automotive Command Automotive Command ATTN: AMSTA-ICB POC: Jack Pilon	C: (313)574-7121 AV: 786-7121
U.S. Army Tank-Automotive Command ATTN: AMSTA-T Warren, MI 48397-5000 POC: Donald W. Cargo	C: (313)574-6191 AV: 786-6191
U.S. Army Tank-Automotive Command ATTN: AMSTA-TMM Warren, MI 48397-5000 POC: Jamie Florence	C: (313)574-6065 AV: 786-6065

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
U.S. Army Troop Support Command ATTN: AMSTR-PP St. Louis, MO 63120-1798 POC: Richard Green	C: (314)263-2672 AV: 693-2672
U.S. Army Troop Support Command ATTN: AMSTR-PPE St. Louis, MO 63120-1798 POC: Gary P. McMichael Julie Sexton	C: (314)263-3417/3418 AV: 693-3417/3418
U.S. Army Troop Support Command Belvoir Research, Development and Engineering Center ATTN: STRBE-TSX Ft. Belvoir, VA 22060-5606 POC: William M. Griffin (Building 327)	C: (703)664-6906 AV: 354-6906
U.S. Army Troop Support Command Belvoir Research, Development and Engineering Center ATTN: STRBE-TSX Ft. Belvoir, VA 22060-5606 POC: Harry Hodges Frank Innis (Building 327)	C: (703)664-5127/5128 AV: 354-5127/5128

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
TRADOC	
U.S. Army Training & Doctrine Command ATTN: ATCD-ET Ft. Monroe, VA 23651-5000 POC: Ronald M. Cross Building 134	C: (804)727-3972 AV: 680-3972
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-CDM Ft. Gordon, GA 30905-5311 POC: LTC William M. Guerra Jon M. Rader	C: (404)791-7118/7177 AV: 780-7177/7118
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-CDL Ft. Gordon, GA 30905-5311 POC: LTC August E. Kertner CPT Michael Mokrycki	C: (404)791-2628/3709 AV: 780-2628/3709
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-CR Ft. Gordon, GA 30905-5311 POC: COL Johern H. Ewing CPT John R. Landress MSG John P. Fillop	C: (404)791-2057/2557 AV: 780-2057/2557
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-ME Ft. Gordon, GA 30905-5311 POC: LTC Geoffrey F. Wells William E. Kelley	C: (404)791-3805/7467 AV: 780-3805/7467

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-TS Ft. Gordon, GA 30905-5311 POC: LTC: Joseph T. Page, Jr.	C: (404)791-7490/7493 AV: 780-7490/7493
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-MS Ft. Gordon, GA 30905-5311 POC: LTC Earl Tingle	C: (404)791-2252/2353 AV: 780-2252/2253
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-FC Ft. Gordon, GA 30905-5311 POC: COL Roger V. Sheffield	C: (404)791-4223/7477 AV: 780-2981/7477
U.S. Army Signal Center & Fort Gordon ATTN: ATZH-AD Ft. Gordon, GA 30905-5311 POC: COL Nelson B. Wright	C: (404)791-2981/7982 AV: 780-2981/7982
U.S. Army Transportation Center & Fort Eustis ATTN: ATSP-CD-MS Ft. Eustis, VA 23604-5394 POC: Richard A. Hartert	C: (804)878-5744 AV: 927-5744

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
U.S. Army Transportation Center & Fort Eustis ATTN: ATZF-TW Ft. Eustis, VA 23604-5361	C: (804)878-2358/5552 AV: 927-2358/5552
POC: COL John G. Larkins (TSM) MAJ Brian Case (FMTV) MR. Lynn Lentz (PLS) SGM Richard P. Camille (HETS) MR. John Wright (HMMWC)	

INSTALLATION/POINT OF CONTACT	TELEPHONE NUMBERS COMMERCIAL (C) AUTOVON (AV)
COMMERCIAL	
Logistics Management Institute 4875 Eisenhower Avenue, Suite 101 Alexandria, VA 22304	C: (703)461-9400 (301)320-2000
POC: Dr. Carl Groth Cynthia Shockley	AV: 284-3029 287-2127/2779
Computer Sciences Division Special Projects Division One North Revmont Drive, Suite 30 Shrewsbury, N.J. 07702	C: (201)389-3410 AV: NONE
-OR-	
U.S. Army Communications-Electronics Command ATTN: AMSEL-RD-TPPO-N Ft. Monmouth, N.J. 07702-5000	C: (201)544-4121 AV: 992-4121
POC: Kenneth A. Tanguay Michael J. Polizotto	

APPENDIX E
DISTRIBUTION

COMMANDER:

AMC, ATTN: AMCDE-AQP (S. Rittenhouse), 5001 Eisenhower Avenue, Alexandria, VA 22333-0001 (1 CY)

AMC, ATTN: AMCICP-FM (J. Francisca), 5001 Eisenhower Avenue, Alexandria, VA 22333-0001 (1 CY)

TRADOC, ATTN: ATCD-ET (R. Cross), Ft. Monroe, VA 23651-5000 (1 CY)

CECOM, ATTN: AMSEL-ED (C. MacDonnell), Ft. Monmouth, NJ 07703-5201 (2 CYS)

CECOM, ATTN: AMSEL-ED-S (J. Barbarello), Ft. Monmouth, NJ 07703-5201 (1 CY)

CECOM, ATTN: AMSEL-ED-P (H. Ivory), Ft. Monmouth, NJ 07703-5201 (1 CY)

CECOM, ATTN: AMSEL-RD-TPPO-N (J. McDonald), Ft. Monmouth, NJ 07703-5000 (2 CYS)

TACOM, ATTN: AMSTA-T (D. Cargo), Warren, MI 48397-5000 (2 CYS)

TACOM, ATTN: AMSTA-IC (P. Young), Warren, MI 48397-5000 (1 CY)

TACOM, ATTN: AMSTA-ICB (J. Pilon), Warren, MI 48397-5000 (1 CY)

TACOM, ATTN: AMSTA-TMM (J. Florence), Warren, MI 48397-5000 (1 CY)

TROSCOM, ATTN: AMSTR-PP (R. Green), St. Louis, MO 63120-1798 (1 CY)

TROSCOM, ATTN: AMSTR-PPE (G. McMichael/J. Sexton), St. Louis, MO 63120-1798 (2 CYS)

BRDEC, ATTN: STRBE-TSX (W. Griffin/H. Hodges/F. Innis), Ft. Belvoir, VA 22060-5606 (3 CYS)

BRDEC, ATTN: STRBE-HP (H. Hambric), Ft. Belvoir, VA 22060-5606 (1 CY)

USASC & Ft. Gordon, ATTN: ATZH-CDM (LTC W. Guerra/J. Rader), Ft. Gordon, GA 30905-5311 (2 CYS)

USASC & Ft. Gordon, ATTN: ATZH-CDL (LTC A. Kertner/CPT M. Mokrycki), Ft. Gordon, GA 30905-5311 (2 CYS)

USASC & Ft. Gordon, ATTN: ATZH-CR (COL J. Ewing/ CPT J. Landress), Ft. Gordon, GA 30905-5311 (2 CYS)

USASC & Ft. Gordon, ATTN: ATZH-ME (COL J. Wells/W. Kelley), Ft. Gordon, GA 30905-5311 (2 CYS)

USASC & Ft. Gordon, ATTN: ATZH-TS (LTC J. Page), Ft. Gordon, GA 30905-5311 (1 CY)

USASC & Ft. Gordon, ATTN: ATZH-MS (LTC E. Tingle), Ft. Gordon, GA 30905-5311 (1 CY)

USASC & Ft. Gordon, ATTN: ATZH-FC (COL R. Sheffield) Ft. Gordon, GA 30905-5311 (1 CY)

USASC & Ft. Gordon, ATTN: ATZH-RD (COL B. Wright), Ft. Gordon, GA 30905-5311 (1 CY)

USATC & Ft. Eustis, ATTN: ATSP-CD-MS (R. Hartert), Ft. Eustis, VA 23604-5394 (1 CY)

USATC & Ft. Eustis, ATTN: ATZF-TW (COL J. Larkins/MAJ B. Case/SGM R. Camille/L. Lentz/ J. Wright), Ft. Eustis, VA 23604-5361 (5 CYS)

DIRECTOR:

IEA, ATTN: AMXIB-P (J. Carstens/J. DeWoody), Rock Island, IL 61299-7260 (2 CYS)

COMMERCIAL:

Logistics Management Institute, ATTN: Dr. C. Groth/C. Shockley, 4875 Eisenhower Avenue, Suite 101, Alexandria, VA 22304 (2 CYS)

MISCELLANEOUS:

DIRECTOR:

DTIC, ATTN: FDA, Cameron Station, Bldg 5, Alexandria, VA 22304-6145 (2 CYS)

IEA, ATTN: AMXIB-P, Rock Island, IL 61299-7260 (55 CYS)